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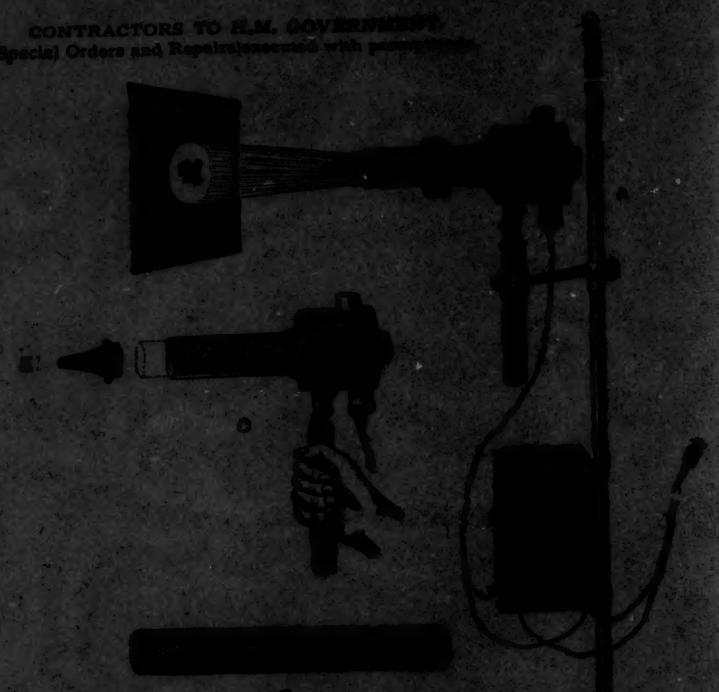

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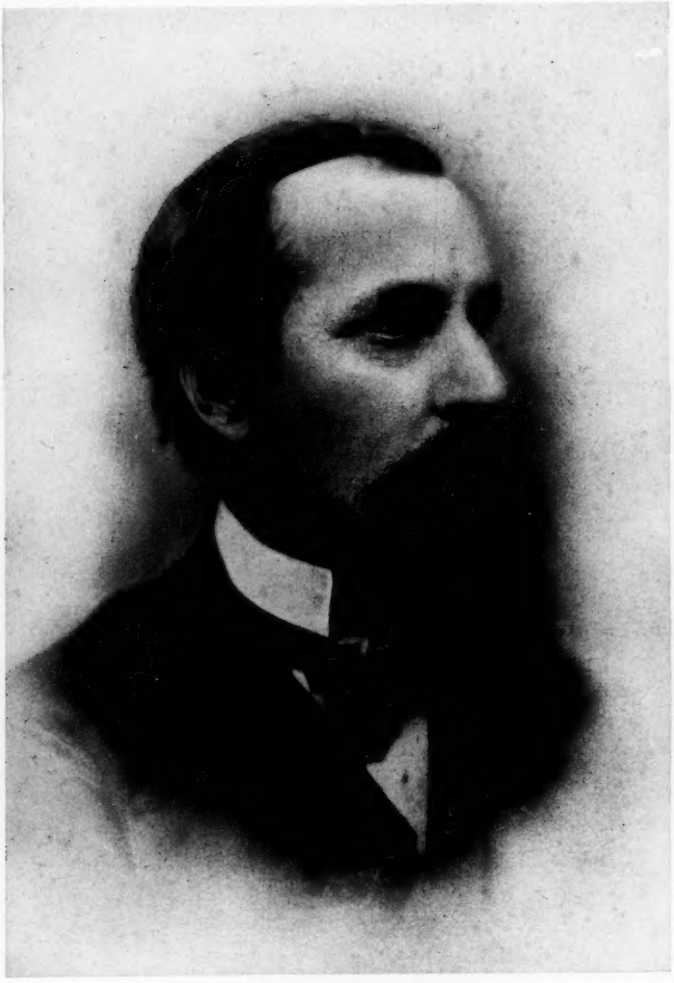


SIR JONATHAN HUTCHINSON, F.R.S.

(1828—1913)

THE BRITISH JOURNAL
OF
OPHTHALMOLOGY
JUNE, 1925

COMMUNICATIONS

BRITISH MASTERS OF OPHTHALMOLOGY SERIES

15.—SIR JONATHAN HUTCHINSON, F.R.S., 1828-1913

BY THE LATE
SIR RICKMAN GODLEE, Bart., K.C.V.O.

Yorkshire

WE older men who remember Sir Jonathan Hutchinson well, recall a tallish dark figure that changed very little from middle life to old age; dark eyes that seemed to look past you through his spectacles; black hair, black beard lengthening and growing grey with age; a suit of black broadcloth and a top hat that grudgingly gave place to a wide-awake. We see him presiding at our medical meetings and addressing them in precise clear-cut sentences, rather solemn, without much sparkle, but full of meat, and made attractive by more than a trace of Yorkshire accent. Or we think of him surrounded by an admiring crowd of doctors amongst his bottles and diagrams at the Polyclinic; or at his hospitable table in Cavendish Square discussing some literary subject with a party of eager surgeons old and young. Or the scene shifts to his other life at Haslemere, where, like a country squire, he led his guests about his estate, studied geology, farming, and diseases of animals and plants, shot his partridges and rabbits, gave lectures on all imaginable subjects at his Museum or retired

to a cottage in his grounds for deep confabulations with his crony, Dr. Hughlings Jackson, undisturbed by the incursions of the family and less scientifically-minded guests.

Let us trace the steps by which he reached his unique position —unique inasmuch as he was a man apart both in personal characteristics and in attainments. On the medical stage he combined the parts of a general consulting surgeon and a specialist in three distinct departments; the public sought his help on three Royal Commissions and recognized his work as an originally minded educationalist; and amongst his friends he was reckoned a connoisseur on literary matters and a hopeful advocate of modern religious views.

No one could have had a more serious start in life, for he was born and bred a Yorkshireman, though his ancestors, who had been strict Quakers since the time of George Fox, belonged to Lincolnshire, where for two hundred years they had farmed a small estate at Gedney in the flat lands near Boston. His grandfather Jonathan, though a good grazier, "contracted at an early period a much greater inclination to the pursuit of abstract and metaphysical problems than simple and obvious truths." Small wonder that he was a "valued minister" in the Society of Friends. His son Jonathan, who was scarcely less devout, a man of strong character and amongst the earlier convinced total abstainers, moved to Selby where he became a prosperous and universally respected "middleman in the flax trade" and here our Jonathan, the second in a family of eight sons and two daughters, was born on July 23, 1828. Early Quakers sought their brides amongst the members of their own Society, so the sober strain was not diluted with worldliness on the spindle side. Jonathan the third was not sent to school; he received his early education from governesses, and thus he was scarcely brought into contact with the outer world—a world rather looked askance at by "Friends" of that day—till he had reached the age of 17 years. Then he was apprenticed to Caleb Williams, a Quaker doctor and minister, who had one of the largest practices in York, but was very unfitted to supply any special intellectual stimulus. After six months, "to his inexpressible pleasure" he obtained leave to commence reading a little " medicine." The following year he entered the York school of medicine and surgery, and the last two years of his apprenticeship he was allowed to attend the York hospital. What limited opportunities during those priceless years compared with those which are offered to the medical student of to-day!

The medical school at York was small enough to justify the well-known story of the solitary slumbering student being roused by the exclamation of the lecturer: "Wake up, Mr. Hutchinson, I've finished." It was not good enough to supply a complete

medical education, but there was at this particular time, 1846-1855, one remarkable personage on its staff. Thomas Laycock, afterwards the well-known and somewhat quizzed "Professor" Laycock —professor of the practiçe of physic—in the Edinburgh University, was lecturer on clinical medicine at this small provincial school. He was a man of philosophic and original mind, more of a mental physiologist than a clinician, who upset many current notions on the physiology of the brain and started the study of unconscious cerebration. He must have influenced the thoughtful mind of young Hutchinson as he undoubtedly did a few years later that of Hughlings Jackson.

London

In order to complete his studies Hutchinson came to London in 1850, attended some lectures at St. Bartholomew's Hospital and took the diploma of M.R.C.S. the same year. At "Bart's" he met another truly scientific man, this time a surgeon, James Paget, still warden of the college, as well as lecturer on general anatomy and physiology, and assistant surgeon to the hospital.

After a brief return to York to serve a house-surgeoncy there, he finally settled in London in 1851 with a minor hospital appointment of clinical assistant at the Liverpool Street Chest Hospital. He was slow in deciding what precisely his life work was to be; for he disliked the thought of general practice, and at one time half thought of becoming a missionary. To account for this we must remember that he was still a strict "Friend," though even at the age of 18 years he had rebelled against some of the more obtrusive peculiarities of the Society. He was a very earnest youth, very systematic and conscientious about the use of time, and full of good resolutions as to its abuse. As his diary shows, he was a methodical reader of solid literature only slightly diluted with the works of such frivolous authors as Shakespeare, Byron, Scott and Tennyson. For a short time he practised a Spartan economy in order to save his father expense, and satisfied himself that the cheapest way of supporting life was a diet of figs and bread. Naturally, when he came to London he dropped into the Quaker circle and joined heartily in their activities. It happened that at this particular time there were several members of the same community who either were then, or afterwards became, distinguished. Hodgkin had an established reputation at Guy's; so had Peacock at St. Thomas's, who in 1846 had taken an active part in the foundation of the Pathological Society, while Daniel Hack Tuke the alienist was Hutchinson's fellow-student at St. Bartholomew's, and his fellow-lodger in Carthusian Street. Lister and Wilson Fox were students at University College, as was Buxton Shillitoe, who was destined

to make a reputation in one of Hutchinson's favourite specialties. With all of those he became more or less intimately acquainted. They all in time emerged from their narrow circle into the great world, but in their earlier years it had no doubt a cramping influence. Thus Hutchinson, yielding to his father's conscientious objections to having anything whatever to do with even the accessories of war, was obliged to refuse a tempting offer of an appointment in the Crimea, where many of his contemporaries were gaining invaluable experience and reputation.

When he had made up his mind to practise surgery his brass plate was put up in Finsbury Circus where he shared a house with the Quaker architect, Wm. Beck. His keenness for investigations of all sorts and his inveterate habit of note taking kept him busy enough though practice came but slowly. He joined the recently formed Pathological Society in 1852, and some idea of his activities may be gathered from the fact that during the first nine years of his membership he is credited with about seventy contributions of one sort and another. Like many young surgeons he coached pupils and wrote for the medical journals. He obtained appointments at two special hospitals—The Royal London Ophthalmic Hospital, and the Blackfriars Hospital for Skin Diseases. Here he could study his three favourite specialties, and to keep his hand in with general surgery, he sought and obtained an assistant surgeoncy to the Metropolitan Free Hospital in the early fifties, and in 1859 he was fortunate in being appointed assistant surgeon to the London Hospital, which henceforth was the principal scene of his labours for twenty-five years.*

Three years before this he had married Jane Pynsent West, who though she came of Quaker stock was not actually a member of the Society. She was a cultivated lady of many interests and devoted, amongst other pursuits, to music and painting. At first they lived at Reigate; but when the London Hospital appointment brought the business of life into the foreground, he moved with his wife and two young children to Finsbury Circus, which became the family home for sixteen years. In those days the City was much further from the West End than it is now. Those who did not own carriages had to travel upon rough paved roads in very primitive cabs or buses. So the younger members of the staffs of the London Hospital and Guy's, at all events, mostly built up their consulting practices in the City and only moved westward, when they thought their reputations warranted the change. The migration was not made without regrets and misgivings; it was like a barrister "taking silk." Internal combustion engines have changed all this and the glory has departed from Finsbury Square and Circus, and from

* He was full surgeon from 1863 to 1883. From 1873 to 1883 he was Senior surgeon.

remote St. Thomas's Street. Hutchinson had become very busy by 1894, when "with some hesitation" he moved into Cavendish Square, then the haunt of the more ambitious medical consultants. Mrs. Hutchinson writing to her daughter in May of this year says: "Our going to the West is very doubtful, I think, after all. Sir James Paget tells papa he *must* go, and give up all hope there of teaching and advancing science, for it is time he attended to No. 1. He can do that there but nothing else. This quite scared papa, and I can't help smiling at how advice which would attract most men, disgusts him, and he thinks he'd better stop here. We have not quite decided yet." At last he made up his mind. Perhaps his nine children turned the balance. The new home was next door to that of his highly successful colleague, Sir Andrew Clark, at that time one of the best known and most fashionable physicians in England, though Jenner, Gull and Quain were all in their prime.

Eight years previously Hutchinson had bought the nucleus of his property at Haslemere, where the children's holidays and all possible week-ends were spent, and to which he ultimately retired when he left London for good in 1911. He farmed at most about 300 acres, much of it wood or copse and impossible to cultivate. Being thus firmly anchored to both town and country, Hutchinson seldom went away for distant or prolonged holidays till science not pleasure tempted him late in life to visit Africa and India.

Objective Education

It seems impossible to trace his progress during the long years of his London life, except by dealing one by one with the different objects to which he devoted himself contemporaneously. They are dovetailed into one another in an altogether inextricable manner; and, after all, no excuse is needed for adopting a method so truly Hutchinsonian in trying to draw his portrait, hoping, as he would have said, to make up for its defects by supplementing it with a full index at the end. "Hutchinson's rôle," says Nettleship, "was in observation, collection, comparison, and the cautious use of a rich imagination"; to which we may add that he was on principle and by inclination a teacher. "Next to the ambition to discover something new," he says, "which after all, is only a higher form of teaching, the desire to be the means of spreading knowledge is the noblest aspiration of the human mind. It is so because it shows faith in light, because it is inclusive of all other aims. 'Let there be more light' will ever remain the morning and evening prayer of every benevolent man." Holding then these exalted views about the privileges and responsibilities of the teacher it was natural that he should have some original ideas about the best methods of imparting knowledge. Not that there was anything

peculiar about his clinical teaching except that which depended on his own personality. His late colleague, Sir Frederick Treves, with his graphic pen, thus describes it in writing to me on September 11, 1922: "Hutchinson was, without question, a great teacher. He attracted, I believe, a larger number of students to his demonstrations than did any other surgeon of his time in London. He had indeed a great following. He was an admirable speaker. He was not eloquent, nor did he make a practice of rhetoric, but adopted a slow, quiet, solemn and modest manner which was very impressive and effective. He made his teaching interesting by the ingenuity of his arguments, by apt illustrations and vivid metaphors and by an occasional quaintness of expression which impressed the memory. Above all were a solemness and simplicity of utterance which was almost monastic. I think a prominent fault of his was a tendency to make facts accord with theory—and he had many theories. For example, at the time when he claimed that syphilitic eruptions were imitative, *i.e.*, imitative of familiar non-specific eruptions, he was shown a man—a sailor—with many pustules on his body. He demonstrated the case as an example of a syphilitic eruption imitating small-pox. The man protested that he had never had syphilis, but this Hutchinson disregarded. The case proved to be small-pox. His theories about leprosy also pressed to a position far beyond that supported by fact."

Nor was there anything exceptional in his lectures and disquisitions at medical societies, except that none could vie with him in his wealth of accurate observations and his skill in marshalling them. Here again the stores of knowledge and clearness of exposition were more impressive than the deductions drawn.

What is meant by his original methods of imparting knowledge may be gathered by turning the pages of the "Smaller Atlas," published in 1895. It is a continuation of a larger atlas, "Illustrations of Clinical Surgery," the publication of which extended from 1875 to 1882, and to which we must first direct our attention. This larger atlas consists of two thick folio volumes of finely executed lithographic plates drawn by Burgess. Burgess for many years made his entire living by drawing for Hutchinson, who was not himself an artist. A great variety of morbid conditions, living and dead, are here illustrated in a way that had not hitherto been attempted. Some of the most striking drawings were made for the Astley Cooper Memorial Prize which Hutchinson won in 1865; it was never published, and, with its drawings and preparations, remains the property of Guy's Hospital. The subject was injuries of the head. He had studied the subject in an exhaustive and practical manner and had contributed at least one

important original observation. He proved that, up to a certain time after rupture of the middle meningeal artery from fracture of the skull, it was possible to determine the side of the clot from the state of the pupils. An observation many surgeons have made use of with thankfulness.

Another disputed point was finally settled by these plates. They gave ocular demonstration that there is such a thing as vaccino-syphilis. A boon, though an unwelcome one, for the British public who had been buoyed up by the assurance of ardent vaccinationists that such a ghastly sequel to arm-to-arm vaccination was impossible. It was a thorny subject to tackle. "I scarcely know," he said, "whether it is desirable that I should say a few words in justification of the publication of these portraits. I am well aware that my former reports were made much of by the opponents of compulsory vaccination, and that they were, with a want of fairness, I fear, almost characteristic, so quoted as to make it appear that I am myself opposed to the Law. In some instances quotations are given, as if from my pen with which I had nothing to do and which expressed opinions very different from mine." He goes on to say that he had met with recrimination and complaint from medical men; but that he was a firm advocate of compulsory vaccination, and that he had done all he could, by remonstrance, to prevent the base use of his facts. And then he continues: "The misguided zealots who have undertaken the anti-vaccination movement are, however, I fear, deaf to all appeals, and but scant fairness and courtesy are to be expected at their hands." He concludes by saying that his own conscience is clear. "In spite of the very serious nature of what I have referred to, I have never been able to regret for one moment that I have made the facts public. Concealment in such a matter appears to me the very worst policy. Let it never be possible for our opponents to say that the medical profession does not dare to look the facts in the face, and to make them public in the freest manner. It is only after having done so that we can meet them fairly and uphold our view of the case.

"We cannot ask that vaccination be made compulsory unless we can honestly say that we have done everything in our power to make it safe. There can be no doubt that the danger of transmitting syphilis is a real and very important one. It can be guarded against only by giving the fullest information respecting it to all the members of the profession, and by attracting their attention to it in the most forcible manner. I should deem myself culpable in a high degree if I failed in my duty in this respect."

These plates were, as far as he knew, the first ever published of vaccino-syphilis. The publication of his views, or it should rather be said his facts, had a definite effect in inducing the medical

profession and indirectly the public to insist on more care being taken in the selection of children for arm-to-arm vaccination. Calf-lymph has now superseded humanized lymph. "I am not prepared," writes Sir George Newman from the Ministry of Health, "to state that arm-to-arm vaccination is *never* practised now, but all vaccination carried out at the public expense is performed with glycerinated calf-lymph, and I should think that instances of arm-to-arm vaccination, if any, must be extremely rare." In their Final Report the Royal Commission on Vaccination stated: "Absolute freedom from risk of syphilis can be had only when calf-lymph is used." We are, therefore, probably justified in saying that vaccino-syphilis is a thing of the past.

This atlas met with a ready sale and the plates were reproduced in America and Germany. It was much valued in provincial schools and by country doctors. The well thumbed volumes at the Royal Society of Medicine show that it is not neglected at the present day. The text being largely clinical has lost nothing of its value in the fifty years since it was published.

After this digression we must return to the preface to the smaller atlas, published fifteen years later in which he makes the statement already referred to about objective teaching. Of this he says in another place: "To those who mourn over frailties of memory, it is a source of much gratification to know that year by year the means of acquiring knowledge are being developed and improved. It is objective teaching which really helps both understanding and memory."

The actual words in the preface are as follow: "I am a firm believer in the value of pictorial illustration as an aid to the acquiring of clinical knowledge and my aim has been to produce a volume which shall place such assistance within reach of all." This book is, like its predecessor, a typical example of Hutchinson's way of teaching. The plates are perhaps not quite equal to the earlier ones and some are rather too highly-coloured. They are mainly of skin diseases, but scattered amongst these are others of gall-stones, cancers, leprosy, diseases of joints, monsters, etc. They are arranged in no sort of order and each plate has a separate, short, pithy description. The book is in fact a museum—a private museum—containing a limited number of common specimens and many of great rarity. It would, therefore, be consulted to-day with one of two objects, either to verify a normal case or to see whether what appeared to be unique had escaped the eagle eye of such a keen observer and inveterate note-taker as Hutchinson.

His firm belief in objective teaching led him in 1868 to suggest to the British Medical Association that they should organize a museum at each of their annual meetings. The idea was at once adopted.

The museum was intended to illustrate "the cream of the year's progress," not only in pathology, but also in the production of foods, drugs, instruments and books. The scientific, and what may be called the commercial sections, were soon separated from one another. It was to the former, with the wax models, drawings, and preparations that Hutchinson devoted his attention. The museum continues to be one of the chief attractions of the annual meetings, though, as the material is collected by local committees, its interest varies with the towns where the meetings are held. Hutchinson had a good deal to do with the British Medical Association about this time. Indeed, he edited the journal for eighteen months after Ernest Hart's retirement in 1869, but relinquished the post, no doubt willingly, on Hart's return.

Confidence in this method of imparting instruction also prompted the formation of his clinical museum, housed at first at the back of No. 1, Park Crescent, and afterwards at the "Polyclinic" in Chenies Street. It contained an unrivalled store of pictures and diagrams, now, sad to say, scattered to the winds. It was intended for post-graduate instruction of medical men, principally of general practitioners—to rub off or to prevent the formation of the rust which so readily accumulates—and to introduce them to new discoveries. The drawings and specimens were used to illustrate the living cases which were shown. The project was warmly supported by Sir William Broadbent, Dr. Fletcher Little and others, though it was looked at with rather a jealous eye, by those who, on the one hand, disliked the system of gratis consultations with doctors over their impecunious patients, and, on the other, were perhaps over-scrupulous about displaying their wares in the view of possible clients. It had, however, a great vogue for a time, but did not long survive the retirement of its founder from participation in its work.

The absence of any provision for post-graduate teaching had long been a cause of complaint by foreigners and humiliation to Londoners. "What a waste of the finest clinical material in the world" it was said! But we simply grumbled about the size of London and the jealousy of the schools, hinted vaguely at a post-graduate hospital and university institute, and, somewhat sadly, watched Americans streaming through London to Berlin and Vienna, and our own graduates receiving their final polish in the continental schools. The failure of the "Polyclinic" was a great disappointment to Hutchinson. He had advanced money for the lease of the buildings and continued to subsidize it. He tried to secure its amalgamation with a general hospital, and to attract a larger number of distinguished teachers to its staff. But in vain. The absence of enthusiasm amongst the teachers and the exiguous fees asked for the pupils chiefly accounted for the

failure. The fact is he was before his time; and one is tempted to ask whether post-graduate teaching can ever be made a great success in our cumbrous metropolis. It needed the friendly rivalry with our brethren across the Atlantic, now bursting with a new enthusiasm, more rapid ocean steamers and the blasting effect of the Great War upon the continental schools to galvanize our present system of post-graduate teaching into life. And, after all, it is a failure at the general hospitals, and can only be described as working fairly well at the special hospitals, where the teaching is chiefly carried on. It looks as if a specially endowed post-graduate hospital could alone satisfy Hutchinson's ideal.

Hutchinson's museum at Haslemere was of a totally different kind, but it was based upon the same principles. He started it in rooms near his own house, but it was afterwards moved to suitable buildings in the town. It was intended for the instruction of his neighbours in almost every conceivable subject, but especially geology, archaeology and natural history. It now contains good local collections, better than those met with in most country museums; but its special feature is a long room in which the attempt is made, with the aid of fossils, drawings and specimens, to show the relation of the different forms of life to the geological periods in which they are first met with. "Space-for-time" may be said to be its motto. When historical times are reached important events and discoveries in science and art, by land and sea, are illustrated in the space allotted to their appropriate centuries. Here he gave informal lectures and addresses, on Saturdays to the young, on Sundays to adults. In the latter he lightly passed from natural science to poetry, and from poetry—often that of Browning or Wordsworth—to Darwinism, natural religion and the belief in life after death, without drawing hard and fast lines between these at first sight incongruous subjects. Sir George Newman, who knew him well, has written a sympathetic memoir of him in the "Friends Quarterly Examiner." In this he speaks of his "being a great believer in objective instruction and learning both by the eye and by cross-questioning." On Saturdays and Sundays it was his habit to discourse to all and sundry in the Museum at Haslemere or in the fields. He would pick a flower and find in it lessons for all who had ears to hear and eyes to see.

Again, a lecture is announced on "the thickness of the earth's crust," but it includes a delightful dissertation on "Elephants" and "John Wesley"; three subjects which it is not customary to take together. But he believed, as he said, in "a mixed diet." Here is another afternoon to be spent with "Whales"; but the whales tail off into the "Influence of Wordsworth's poetry" and "Tuberculosis and Leprosy as Social Questions." There is no

holding such a tutor. Yet there was no madness in it. It was part and parcel of his scheme. "The human mind," he argued, "is infinitely varied, and to teach a miscellaneous group of persons calls for a diversity of information and method." These Sunday lectures were well attended, and, far from being tabooed, were welcomed by the broad-minded incumbent of the parish.

Hutchinson founded a similar museum at his native town, Selby, which was handed over to the Urban District Council after his death. He hoped that his example would be followed in other parts of the country, but we do not meet with similar museums elsewhere. The Haslemere museum is still an important educational establishment because it possesses the essential element of success, namely, an energetic curator up to his work and a good teacher. Frequent demonstrations and lectures are given there and examinations are regularly held.

A natural outcome of the system followed at the Haslemere Museum was the publication in 1897 of a second edition of "The Centuries," the first edition of which had been printed privately years before. It is described as "a chronological synopsis of history on the 'space-for-time' method." Its purpose may be gathered from the opening words of the preface: "The present work is designed as a study-table companion for all readers of Biography or History. It is intended to supply a skeleton-conspectus of General History, and to serve at the same time as a note-book for the reception of additional memoranda. In this way it is hoped that it may be the means of encouraging and facilitating a wider study of history than is generally thought practicable." The volume—it can hardly be called a "book"—consists of 122 large octavo pages nearly half of which are blank. Starting with the arbitrary date 10,000 B.C. as that of the probable dawn of history, he passes over the first twenty centuries because they are almost devoid of recorded facts, and begins with 3,000 B.C., which is his seventy-first century. Four pages are devoted to each subsequent century; the first two containing a synopsis and memoranda arranged in decades, and the other two being left blank for additions by the reader. In the labour of compilation he was greatly helped by Mr. Harold Smith, a well-known K.C. It must indeed have been a heavy task. The result is a fund of information as to contemporaneous events occurring in different parts of the world, and a convenient note-book for students of History or Biography.

During the same year, 1897, he published a small duodecimo of 96 pages called "Life Register," dealing this time, not with the general history of the world but the minute details of one human life. "So teach us to number our days" was its motto, and first the parents and then the owner of the book himself were

invited to be the authors. The Register may be begun at any age, but if it be started at birth, the parents are supposed to keep it for the first fifteen years, recording the child's health, mental and physical development and usual or occasional places of residence, then the subject himself takes up the autobiography, filling in, if he has patience to do so, a page divided into monthly periods for each year of his life up to his seventy-second year, when he may lay the weary pen aside. The "Life Register" is arranged on the same lines as the more elaborate "Life Album," prepared by the British Medical Association some years before, and mainly produced by Sir Francis Galton; but it was by no means a copy as it was in existence long before the album was published. It begins with some prefatory instructions as to the method of keeping the register, and ends with a few simple memoranda as to the management of health.

In these two publications Hutchinson was clearly trying to enlist his intelligent fellow-countrymen in the campaign for the recording and marshalling of well ascertained facts.

Hypotheses; Leprosy. Debate on Syphilis

It has often been said by those who allow Hutchinson's pre-eminence as a teacher that his deductions were sometimes scarcely justified by the facts on which they were founded, or that he tended to make facts accord with theory; and his work on leprosy is always cited in support of this statement. His interest in this puzzling disease began in 1855 in consequence of observing some cases at the London Hospital, and it only ended with his life.

In 1863 he propounded what he called his "fish hypothesis" —"that decomposing fish is the one sole cause of leprosy"—and in consequence he became a disbeliever in the infectiousness of the disease and an opponent of the segregation of lepers as cruel and useless. Neither the discovery of the leprosy bacillus by Hansen in 1874, nor any argument of his opponents caused him to give up, even if he somewhat modified, his theory. In 1899 he visited Norway, where the smell of salt fish stinks in the nostrils to this day and leprosy still prevails on parts of the west coast. In 1901, feeling, as age advanced, that the cause in which he still believed "might soon be without an apologist," he went to South Africa to test upon the spot the truth of the oft-repeated assertion that leprosy occurred there in people who had no access to fish, either fresh or putrid, and convinced himself that this was not the case.

In the following year he made a similar tour of investigation and propagandism in India from which he returned more confident

than ever, and in 1906 he published the result of his life-long studies in a book of 400 pages.* He apologizes for addressing the public as well as the profession on a medical subject, urging as an excuse the pressing importance of the subject and the shortness of human life. It is couched in simple and comprehensible language and forms a readable, indeed a fascinating treatise.

Two quotations from it may be given which are good examples of his style of writing:

"It may be well here to repeat briefly that the fish hypothesis is not at present prepared to suggest the precise mode by which fish becomes the cause of the disease, or to specify any particular kind of fish, other than that it is fish in a state of partial decomposition. It assumes that really fresh fish and really well preserved fish are both alike innocuous, but that either cured or uncured fish in commencing decomposition may occasionally contain an ingredient which shall be effective in the causation of leprosy. Whether that ingredient be the bacillus itself or some toxine capable of stimulating and differentiating the tubercle (*sic*) bacillus already present in the patients' tissues, it does not profess to decide. It assumes that it is probable that even in fish in a state of decomposition the presence of the dangerous ingredient is exceedingly rare, but that a very small quantity of fish containing it may be efficient in the production of the disease. Thus the large or small consumption of fish has comparatively little to do with the matter. It is not the excessive use of fish, but the accidental reception of a specific ingredient in connection with it, which determines the occurrence of the disease,"†

This is a good enough, though somewhat parenthetical example of a hypothesis if we accept the logician's definition of a hypothesis as "an explanation, supposition, or assumption which is put forward in the absence of ascertained facts and causes."

Before, however, any hypothesis can mature into a real explanation, or, as it is technically called an "inductive truth," great care must be taken in collecting and testing all ascertainable facts to see if they are, every one of them, explained by it, and if no other law will explain them. The following is a fair example of Hutchinson's method of marshalling his facts; the reader can judge whether it is precise enough to have satisfied, say, John Stuart Mill:

"I may confess that when I first realized the fact that leprosy is unknown in the north of China, and that the districts from which it is absent abound in salt and have very little fish, I thought that it brought the question to an end. Nor has subsequent

* On leprosy and fish-eating. Archibald Constable & Co., 1906.

† *Loc. cit.* p. 192.

investigation much modified that impression. I can see no escape from the inference that the two facts are in connection as cause and effect. In order to avoid fallacies, I inserted in the pages of the *Lancet* a short letter, asking those more conversant than myself with the social and dietetic habits of the Chinese whether any other explanations could be suggested. This letter has gained me no information. So far as is known the food of the residents in the north is the same as that of the south (where leprosy is prevalent), with the single exception of the abundance of salt and the deficiency of fish. Thus we are enabled to put aside the suggestion of pork, decayed vegetables, and other articles, of which it has been said that they may possibly be causes of leprosy."*

The "fish hypothesis" never met with general—or indeed very wide—acceptance; but the tale is told so graphically in the book that, after reading it, one can hardly avoid a sort of sneaking suspicion that there must be something in it after all.

Before leaving the subject of Hutchinson's method of arguing we may give one other example of his hypothetical laws. It was intended to explain such bilateral diseases as "sympathetic ophthalmia." It runs thus: "All forms of common inflammation have the power of so infecting the blood as to induce similar processes elsewhere." From which, if it turned out to be true, another law naturally followed: "There is another law of selective affinity underlying the general one of blood contamination which renders it likely that the secondary process will be set up in certain definite parts, to the exclusion of all others."

These are both extremely suggestive, and though one may call to mind Dr. Moxon's cynical remark about the "fallacies of universality, totality, and unity," it must be remembered that hypotheses are the stock-in-trade of deductive philosophy, some of which stand the test of experiment while many, perhaps most, have to be laid aside.

Moxon's clever and witty speech was part of a very full-dress debate on the pathology of syphilis opened by Hutchinson in a highly philosophical paper which he read before the Pathological Society of London in February, 1879.† It was a memorable occasion and marked a distinct step forward in the study of the disease. The stages of syphilis, its relation to specific fevers, the symmetry of its earlier manifestations, the visceral lesions, its probable microbial origin and the vague question of how long, if at all, it might be described as a "blood disease" were all warmly discussed. It was then that Gull startled us by one of his

* *Loc. cit.* p. 217.

† *Trans. Path. Soc.* xxviii., p. 341.

unforgettable phrases: "Well I think syphilis is a flesh-and-blood fever." And again: "Syphilis once, syphilis ever; syphilis general, syphilis universal, in the man as long as he lives." Hutchinson wound up the discussion with a lengthy written reply which, as well as the whole debate are well worth reading to-day, if only from the historical point of view.

Ophthalmology

When he was dealing with facts and his faculty for observation had full play, Hutchinson's work was but little open to criticism, and much of it was so sound and so new that his name will, one imagines, always be connected with certain well recognized pathological conditions and clinical processes. He has been wittily called the greatest general practitioner of his day in Europe; the jibe, of course, referring to his distinction in so many specialities. He would have freely admitted that he could not have accomplished so much in such different lines if he had not been supported by a company of adherents and admirers. Amongst them special mention must be made of two—both shy men—who worked with him at the London Hospital, Moorfields, and Blackfriars, and in private practice. One was Edward Nettleship, who, in spite of his retiring disposition, reached the most prominent position amongst the ophthalmic surgeons of his day. The other, Waren Tay, who is still with us, always hid his brilliant light under a bushel.

Hutchinson was early attracted to the science of ophthalmology. He worked at Moorfields indefatigably for sixteen years, 1862-1878. His best known contribution to the subject, a very important one, was the discovery that interstitial keratitis is caused by congenital syphilis, thus distinguishing it from strumous ophthalmia with which it had formerly been confused. This distinction had important practical results, especially in places where both diseases are rampant, as was the case amongst the miserably poor population of the east end of London. At the time he made this discovery he was much interested in the subject of congenital syphilis and "Hutchinson's triad" became a recognized medical term. It included interstitial keratitis, notched teeth and labyrinthine disease.

We may note, in passing, that this is not the only recognized medical term of which Hutchinson's name forms a part. Others are 'Hutchinson's facies" in ophthalmoplegia, "Hutchinson's pupils" in meningeal haemorrhage, and "Hutchinson's teeth."* "Hutchinson's splint" is perhaps forgotten; "Hutchinson's lotion" reminds us that he devised a simple antiseptic treatment of his own —very useful in some cases—which consisted in the continuous

* First communicated to the Pathological Society in 1857-8-9.

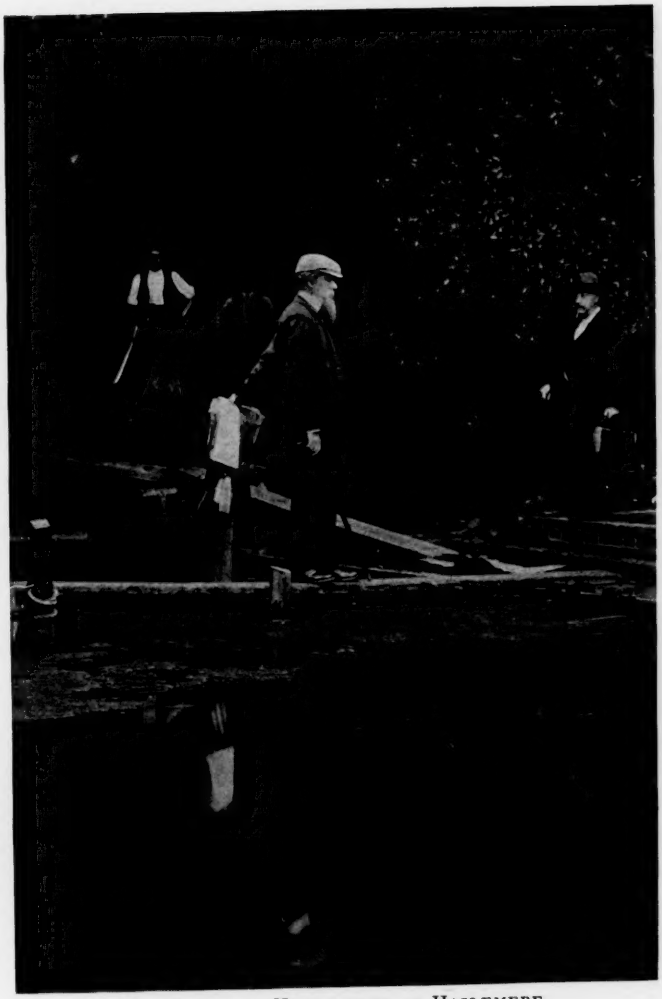
dropping of a lotion containing liquor plumbi diacetatis, spirit of wine and water, in varied proportions, on to lint laid over recent compound fractures and some surgical wounds.

Less outstanding ophthalmological work of Hutchinson's, according to Nettleship, is included in his writings on "dental defects seen in children who have suffered from convulsions and who often have lamellar cataract," "tobacco amblyopia," "a particular form of iridocyclitis in young persons whose ancestors suffered from gout," "ophthalmoplegia," "recurrent haemorrhages into the vitreous in young men," "haemorrhagic retinitis" and many others safely interned in the medical journals.

Syphilis

Syphilis—that protean disease—in all its aspects fascinated Hutchinson from the first. It led him into those bypaths the pursuit of which made him a multi-specialist. The results of his prolonged study were given to the world in a duodecimo volume of 530 pages in 1887 (of which an enlarged edition appeared in 1909). It is vastly more interesting than the ordinary text-book or monograph, and illustrates clearly how Hutchinson's methods of study and composition differ from those of the ordinary systematic professor. It is the work of a thoughtful clinical observer. "In the following pages," he says, "I have aimed less at systematic completeness, than at clinical exposition. To the latter subject I have devoted my best efforts, and my hope is that those who may honour this work by their attentive perusal, will obtain from its pages clear impressions of the present state of our knowledge on most of the topics which it concerns. Nor will they, I hope, miss suggestions as to the kind of research which is yet needed in many directions. It has been my endeavour to make the numerous case narratives tell their own story, and to allow their various weak points, as items of evidence, to be apparent. I trust it will be found that no attempt has been made to exaggerate the precision of our knowledge, and that, as far as possible, all dogmatic assertions have been avoided. The attempt has been to point the way to general principles, which, once accepted, may obviate the necessity for much of the detail which we find in systematic treatises."

Acting on this principle he divides the book into two parts. The first, only a fifth part of the whole, is all that is devoted to "general statements," *i.e.*, a systematic description of symptoms, diagnosis and treatment. The second, and far the most important part is occupied almost entirely by 243 "commentaries" the majority of which are accounts of actual cases. Its object and scope are thus explained: "I have endeavoured, in the preceding pages, to give a general sketch of syphilis in its various stages



SIR JONATHAN HUTCHINSON AT HASLEMERE

and different forms. I have abstained almost wholly from the production of cases, and have avoided the discussion of moot points and exceptional facts. I propose now to go over the same ground again, but in quite a different manner. The standpoint will here be that of the clinical observer and practitioner, and I shall endeavour, by the citation of cases, and occasionally of statistics, to illustrate the various assertions which have been made as to the laws under which the different affections due to syphilis are developed. In this way I shall hope to fill many gaps which have been left in the previous concise narrative, and also to bring into stronger prominence the more important facts as regards diagnosis, treatment and prognosis. In doing this it will be inconvenient to attempt much in the way of arrangement. Many of the case-narratives will bear at the same time on questions relating not only to the different stages of the disease, but to both its acquired form and congenital forms. I shall, however, group my facts so far as they admit of it, and shall hope to remedy defects on this score by a full index at the end of the volume."

Such a record of facts can clearly never be out of date, and fortunately, the book was written late enough in the day for its author to be a confirmed believer in the germ theory. "The creed which will be found to interfuse not only this work, but almost all that I have ever written on syphilis, is that the disease depends upon a living and specific microbe, and that it is contagious or transmittable only so long as that microbe retains its vitality. It is, I believe, of the utmost importance to keep this doctrine clearly in mind, for it simplifies our reasoning and clears our view at every step. Considering the successes which the study of bacteriology has attained of late years, it is certainly surprising that no one has as yet been able to demonstrate the special microbe of syphilis. That this discovery is in reserve for some future investigator, I have the utmost confidence in believing."

This was written eighteen years before the spirochaeta pallida was discovered in syphilitic lesions, and, although seven reprints of the book were issued between 1887 and 1899, Hutchinson waited till the relation of the organism to the disease was fully established before issuing his second edition in 1909. It had now grown from a large duodecimo into a small octavo containing about twenty more pages. It had been both compressed and expanded and to a large extent rewritten; so much so, indeed, that its original features are a good deal masked. It was no longer divided into two parts and its quaintness and picturesqueness were diminished—almost lost—by the disappearance of the "commentaries." It was still essentially a clinical treatise, but more methodically arranged and more complete than the first edition. It was still eminently readable and wholly free from the dryness of the typical text-book.

The spirochaete now holds the stage and the "Wassermann reaction" is in full swing. Hutchinson treats them both with a certain aloofness. He dwells upon the difficulties of the former and the chances of error in the latter. In the preface he says: "We must await hopefully the results of further research, and in the meantime, continue to put our trust in clinical methods of inquiry which in the main these [investigations] seem to corroborate."

As to the spirochaete itself he writes: "The discovery had, however, been so confidently foreseen, and had by inference so definitely interwoven with the texture of our creed, that now that it has been actually made it brings us but little help. The phenomenon of syphilis had been claimed as being certainly the result of a parasitic contagion, and the disease had been placed in the category of specific fevers which observe stages. We had, therefore, but little to learn from the ocular demonstration of the parasite and the giving to it of a name. To those minds incapable of accepting as practically proven anything not actually demonstrated, the discovery is invaluable; and, at the same time, it furnishes an important weapon of defence to those who for themselves had long ago accepted its conclusions."

The preface gives a valuable insight into his personal history, showing how he was led irresistibly by his other pursuits to a deep study of syphilis and to publish its results; how in spite of a desire rather to avoid than to cultivate a practice in venereal diseases, the opportunity was forced upon him of turning his attention to its effects amongst educated people; and how he thus came to form very decided opinions upon the social questions involved. The most difficult of these is the terribly responsible one of how soon after apparent recovery marriage is permissible. His views were held by many to be too optimistic and it was said that the interval he considered adequate was too short. But Hutchinson, as might be expected, stuck to his guns. He was, as he says, "a diligent note-taker," and spoke as if his ripe experience had attained to "something of prophetic strain." "My own years," he says, "having been unusually prolonged, in association with fair powers of memory and mental vigour, I have been able to secure a kind of experience which falls to the lot of but few. I have seen many of those whom in their early vigour I had treated for syphilis, now in honoured grey hairs and apt to boast of their grandchildren." Modern methods of diagnosis and treatment, afford firmer ground for forming an opinion on this subject than was possible in Hutchinson's day, and support the views of those who would err, if at all, on the side of caution.

Some of his observations on congenital syphilis have already been mentioned, and also his insistence on the way in which the

outward manifestations of syphilis mimic those of other simple or less constitutional diseases. He published a pamphlet on the latter subject in 1879. It may have been the resemblance of syphilis to other diseases which led to his most important contribution to syphilography, which was propounded in the first volume of "Reynolds' System of Medicine," published in 1866. This was the now generally accepted fundamental doctrine that syphilis is a specific fever like the acute specific fevers; only differing from the acute specific fevers in the prolonged intervals between the various stages—infection, pyrexia, appearance of the rash, sequelae and so on. He was able to produce an ample array of facts to support this theory. His work on syphilis was so original and so eminently practical that he was everywhere recognized as one of the leading authorities on the subject.

The great debate at the Pathological Society has already been referred to.

Dermatology and Neurology

Syphilis and dermatology always run in couples because so many syphilitics consult a skin doctor first, and it is natural that many sufferers from simple skin affections should find their way into the consulting room of the syphilographer. No wonder that Hutchinson thought it worth while to become attached to the Hospital for Diseases of the Skin in Blackfriars Road, and that he should have been a member of its staff till 1897. In time he became as great an authority on this as in his other specialties. A leading dermatologist writes thus with regard to his contributions to the science: "Hutchinson, as far as I can visualize him was a collector pure and simple as far as dermatology was concerned. He loved to collect rare skin cases for his museum and many of them he published in numerous atlases. He certainly added a considerable number of names to dermatological literature, and was undoubtedly the first to describe the clinical features of many now well recognized dermatoses. As far as I know, however, he never pushed his investigations very far, so that most of these conditions were subsequently described and worked out under other names, and only afterwards was it found out that they were previously described by Hutchinson." No doubt he did a great deal of useful work for dermatology, and he is not the only one whose discoveries have been re-discovered and named after some later discoverer, British or foreign—mostly foreign!

Neurology has sometimes been added to the list of Hutchinson's specialties, but that is rather an exaggeration—a picturesque addition to his portrait. A former pupil and colleague of his, now a well-known neurologist, writes: "I cannot recall that Hutchinson made any permanent and valuable additions to the science of

neurology. He reported some excellently observed cases of divided nerves, and was always greatly interested in Hughlings Jackson's views. In fact, he was not only responsible for Jackson's candidature for the staff of the London Hospital, but throughout all the earlier years they were together as colleagues they were intimately associated in clinical work. This was greatly accentuated by the fact that both men were profoundly interested in introducing the use of the ophthalmoscope. Of course, Hutchinson's preoccupation with syphilis brought him into frequent contact with diseases of the central nervous system.

General Surgery and Medical Politics

Having this wide outlook upon the science and practice of medicine, Hutchinson came to be regarded as what has been called a "medical surgeon"—a title highly appreciated by those who take the right view of surgery. The number of references to his name in the first edition of Dr. Hilton Fagge's "Handbook of Medicine" gives some idea of the esteem in which he was held by the leading physicians of his day.

It must not be thought, however, that all his energies were devoted to exploring alluring bypaths, though men of average ability and diligence may find it difficult to understand how those excursions allowed him time to pursue what he no doubt considered the main business of his life. The first duty of his most active years it must be remembered, was that of surgeon to the largest hospital in London. For most of this time he was in charge of over sixty beds, and was followed by an eager following of students whom he engaged to instruct in clinical and systematic surgery and medical ophthalmology; and he was not one to shirk duties solemnly undertaken. In addition to this he acquired in time a large general surgical practice, the burden of which, however, was somewhat lightened in later years when his eldest son—the fourth Jonathan in succession—became a member of the staff of the London Hospital, and his father's right-hand man in Cavendish Square. It would distort the picture, however, to dwell very long upon Hutchinson's general surgical work. His fame does not rest upon this. But even if he was not exactly a pioneer in general surgery he added more than his quota to its science and to its art. He came rather too late in the day to take part in the advances of bacteriology which for a time distracted the attention from what may be called the old-fashioned method of surgical advance. This was all the while, however, proceeding unostentatiously, and Hutchinson's share in the work was at least equal to that of most of his well-known contemporaries.

He has been described as a safe but not a brilliant operator;

and this, at a time when brilliant operating was beginning to be looked upon with suspicion, must be counted to him for merit.

The transactions of medical societies, the larger atlas, and the medical journals afford sufficient evidence of the variety of his contributions to general surgery and pathology. It is hard to make a selection from these, but his work on traumatic separation of epiphyses, head injuries, diseases of the tongue, high amputation for senile gangrene, cancer and melanosis, and the operative treatment of intussusception give some notion of their value. To these may be added his insistence on the importance of chronic irritants in the production of epithelial cancers, his conception of a precancerous stage of cancer and the production of cancer by the administration of arsenic, and enough will have been said to indicate Hutchinson's position in the march of general surgical progress. He was in fact acknowledged to be one of the leading London surgeons of his day. He became in due course a Fellow of the College of Surgeons, Hunterian Professor (Surgery and Pathology, 1879, 1883), Member of Council, Examiner and finally President (1889-90). At *viva voce* examinations his solemn manner was rather depressing. He liked to adopt the strictly logical, though dull and it must be owned unusual method of putting the same series of questions to all the candidates. It was an original idea and made it easy to appraise the merits of the candidates till the news of what was taking place leaked out into the "funking room," as it was apt to do. Be we hasten to add that perfect examiners are so rare as to be almost unknown.

He was President in succession to all the larger medical societies and to some of the smaller ones, the list of which it would be tedious to enumerate.

He was made a Fellow of the Royal Society in 1882 in recognition chiefly of his various contributions to the study of "the natural and clinical history of disease both in man and the lower animals."

He was a member of the Royal Commission on small-pox hospitals in 1884, and of that on vaccination in 1890-96. So it may be fairly said that he played his part in the medical politics of his generation. In recognition of his many services he received honorary degrees from most of the existing universities in the kingdom, and several honorary distinctions were bestowed upon him abroad. He was knighted in 1908, having, it is commonly reported, previously declined the offer. Such wordly honours were in his younger days very seldom accepted—if offered—by members of the Society of Friends to which he remained attached, if by rather a loose rope, to the end of his days, and this may have strengthened a natural distaste for an "empty title."

The New Sydenham Society

A bibliography, as full as can be made without great labour, is appended to this memoir, but it gives a very imperfect idea of Hutchinson's literary output. His writings are scattered far and wide in journals and magazines. And not content with these efforts, but as it were, to fill up spare moments in his busy life he devoted much time and energy to the New Sydenham Society which, Phoenix-like, rose from the ashes of the Old Sydenham Society in 1859. The "Old" Sydenham Society, founded in 1843, died from want of support. Hutchinson alone pleaded for its continuance and on hearing Sir John Forbes's taunt that if younger men wanted such a society they had better start one for themselves took up the challenge, and with the assistance of his friend Sedgwick Saunders promptly founded the new one. For almost fifty years it poured out, at a very moderate price to subscribers, a succession of translations of foreign books, atlases, collected editions of British authors and collected essays. No fewer than 194 volumes appeared before the society came to an end in 1906. During the whole of its lifetime Hutchinson was the Honorary Secretary. Distinguished men occupied the Presidential Chair; distinguished men helped in supplying material and translations, but Hutchinson was the life and soul of the society. The volumes occupy much shelf space, more than most private libraries can afford. That is why permanent subscribers were comparatively few and tended to fall away. In a public library the publications give easy access in the English tongue to many invaluable foreign classics, together with, as may well be supposed, a number of works whose interest has been more or less ephemeral. Some of its best publications were entirely of English origin. Its atlases of skin diseases and of pathology were found of great value. Its one great mistake was the issue of an elaborate and long-drawn-out dictionary of medical terms; but for this Hutchinson was in no way responsible. In fact he was opposed to the undertaking from the first.

Epitome

The difficulty of estimating the relative value of Hutchinson's contributions to science arises from their number and their variety. There is a similar difficulty in giving a true impression of the personality of such a many-sided man. So far we have studied it chiefly from the point of view of medicine. Few have worked so hard during a long life both in and for his profession. In most of this he had no thought of personal reputation or advancement. To whatever cause he believed in he gave unstintedly both time and money. The profession throughout the world has been

influenced by his teaching and discoveries, many of which, it is fair to assume will always be associated with his name.

For the other sides of his character, so different from and yet consistent with the first we must turn again to his life in the country. He was never a really practical farmer, having, like so many busy country-loving doctors, to work vicariously through a bailiff. But, as might have been expected—and this was the subject of mild chaff—he was quite as keenly interested in the diseases of his stock as in their quality. He loved dogs, and was revered by successive generations of spaniels. With these he walked down his partridges in old-fashioned style; but he was more attracted by the exercise for himself and his friends than the sport and was easily drawn aside by some botanical or geological detail or curiosity. He was a good shot himself, which was more than could be said of some of those who joined in the merry though perilous London Hospital shooting parties.

The "Library Inval" contained a carefully arranged collection of professional, scientific, and general works. His literary tastes were broad, but they had limitations. He was devoted to Shakespeare, Wordsworth, Browning, and Carlyle. He read widely in history and biography, but was not, like his friend Hughlings Jackson, a voracious novel reader. On the contrary Dickens, Thackeray, and Meredith, were unexplored ground, and the mild domesticities of Trollope satisfied his appetite for fiction. Tennyson, Morley, and Tyndall, were personal acquaintances, and he was familiar with their works, though not greatly attracted by them.

He was always a student of natural history and a keen observer, with the naked eye and the microscope, of plants and the lower forms of animals. He did not publish any papers on these subjects, though they were often used as effective illustrations of professional and lay discourses.

Recreation with him meant change of study. Every day he was at work upon one subject or another, and his power of continuous application was extraordinary. He never seemed to tire except when prostrated by occasional headaches, and those who knew him most intimately were astonished at the amount of intellectual work he could accomplish. In the country, many hours a day were devoted to these studies, and they were continued on the journeys to and from London and even during the fragments of hours between one patient's house and another's. But *labor ipse voluptas*!

After thirty years of married life, enlivened by his family of ten children, Hutchinson was left a widower in 1886, during the height of his professional activity. His declining years were fully occupied in spite of some of the inconveniences of old age. He

went abroad as we have seen. He studied as of old. It is said, for example that when at last he could go but little out of doors his daily wood-basket supplied him with material for comparing the tumours of trees with those of men.

This is not the occasion to do more than hint at the effect produced by Darwin's writings and the whole trend of scientific thought during the second half of the nineteenth century, upon his logical mind, brought up as he had been amongst the restricting influences of the Quakerism of his youth. His emancipation was made clear in his Sunday lectures and sermons. And when he died at the ripe age of 84 years, on January 23, 1913, it was in the parish churchyard that a goodly company of friends and admirers gathered round his grave. And here, as he directed, these words are inscribed upon his tombstone:

"A Man of Hope and Forward-looking Mind."

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A REVIEW OF THE LITERATURE ON THE CRYSTALLINE LENS

BY

DOROTHY ROSE ADAMS

So many articles have already been written on the subject of the crystalline lens, that an attempt to add to their number seems to demand an apology. So far, however, ophthalmologists and chemists have carried on their investigations independently, and it is hoped that this article will serve to correlate what is known of the biochemistry of the lens with the changes observed in pathological, and more especially, in cataractous lenses. The first half of the paper is a summary of the facts which have been brought to light, merely by chemical analyses of normal and cataractous lenses. The latter half deals with the action of light on the lens, and enters more fully into a discussion of the probable causes of cataract.

A. Chemical Analyses of the Crystalline Lens

An analysis of the human lens was first made by Berzelius, who gave the name of krystallin to the lens protein. Further analyses of animal lenses were made by Laptschinsky, 1876, and Morner, 1894. The latter identified three proteins:

(1) Albumoid, a proteinoid which is found especially in the nucleus of the lens, and which is insoluble in water and in acid.

(2) Two water-soluble proteins, which like globulins, are completely precipitated by saturation with magnesium sulphate at 30°C. One, β-krystallin, is soluble in acetic acid solution.

The krystallins were found to preponderate in the cortex, α-krystallin in the outer, and β-krystallin in the inner layers. Coagulation temperatures on heating the proteins with 0.05—0.1 per cent. KOH, were for α-krystallin 72°, β-krystallin 63°, and for albumoid 50°. Morner also found slight traces of albumen, and identified the presence of cholesterol and lecithin. He estimated the nitrogen and sulphur contents of the proteins, and obtained figures which compared very favourably with those of Jess, who, at a later date, was able to use much better methods of purification and analysis:

TABLE I.

NITROGEN.			SULPHUR.	
(Morner, 1896)	(Jess, 1921)		(Morner, 1896)	(Jess, 1921)
16.62 per cent.	16.34 per cent.	**Albumoid**	0.70 per cent.	0.87 per cent.
16.68 per cent.	16.46 per cent.	**α-Krystallin**	0.56 per cent.	0.68 per cent.
17.04 per cent.	17.00 per cent.	**β-Krystallin**	1.27 per cent.	1.34 per cent.

The protein content of the lens was found to vary with age, a decrease of protein in old age being noted by Cahns, Michel, 1884, and Wagner, 1886. Wagner also observed that in a senile cataractous lens, no protein could be found in the nucleus of the lens, and only a trace of globulin in the cortex; whereas in other forms of cataract, *e.g.*, traumatic and lamellar, normal proteins were found. Morner had shown (1896), that the amount of insoluble protein increased in the senile lens, a process rather analogous to the formation of keratin in the skin. Jess (1920), proved that there was a simultaneous decrease in the amount of water-soluble proteins, especially of β-krystallin, and he suggested that this might lead to the hardening of the nucleus and the sclerosis which cause a loss of the power of accommodation in old age. By the use of Fischer's method for protein hydrolysis, and Abderhalden's method of amino-acid estimation, Jess was able to make a thorough analysis of a large number of ox lenses. His figures (1921 and 1922) show interesting differences in the amino-acid contents of the three proteins.

TABLE II.

In 100 gm. substance:—

	α-KRYSTALLIN		β-KRYSTALLIN		ALBUMOID	
Glycocoll	0		0		0	
Alanine	3.6		2.6		0.8	
Valine	0.9		2.1		0.2	
Leucine	5.7		2.8		5.3	
Aspartic Acid ...	1.2		0.4		0.5	
Glutamic Acid ...	3.6		2.7		4.6	
Tyrosine	3.5		3.7		3.6	
Proline	1.8		1.4		1.9	
Phenyl Alanine ...	5.5		4.1		4.6	
Serine	+		+		+	
Tryptophane ...	+		+		+	
SH. as Cystine ...	2.3	(cystein & cystine)	4.9	(cystein & cystine)	3.1	(cystine only)
Melanin	1.1		0.1		0.6	
Histidin	3.635		2.63		2.74	
Arginin	7.85		7.5		10.26	
Lysin	3.75		4.6		3.8	
Ammonia	7.1		11.4		6.0	

Tyrosine and tryptophane are present in each of the proteins, while glycocoll is absent from them all. β-krystallin gives a strong positive test for cystein, whereas α-krystallin contains only a little, and albumoid practically none. β-krystallin is peculiar in its large content of valine, alanine, ammonia and cystein, while it is comparatively poor in melanin and leucine. Albumoid is markedly poor in valine, but richer in arginin than the other proteins. Because of its low content of glycocoll and alanine, it cannot be classed as a skeleton protein. The proportions of diamino- to mon-amino-acids in the krystallins make them resemble albumens rather than globulins.

The most interesting fact arising from Jess's analyses, is the variation in the cystein content of the proteins. As in other animal tissues, the presence of cystein (or of an SH-compound) in the lens, causes it to give a strong purple colouration with an alkaline solution of sodium nitroprusside (Arnold, 1910). The reaction is not diminished by drying the lens, nor by long storage of the lens in alcohol or formalin (Reis, 1912), and it is still given by the water-soluble proteins after precipitation. Albumoid has no nitroprusside reaction. Heffter stated that the reaction is negative in proteins which will not reduce sulphur to H_2S, such as fibrin, casein, and ovomucoid, *i.e.*, those which do not contain cystein or any S.H. compound. This fact is confirmed by Jess's observations that not only does albumoid lack cystein, but that in a senile

or cataractous lens from which the nitroprusside reaction is absent, or diminished, albumoid is present in increased amount. Jess thinks that this protein has actually replaced β-krystallin, to which the nitroprusside reaction of the normal lens is chiefly due. In criticism of this view, it is probable that soluble protein diffuses out from the lens into the aqueous in the early stages of cataract, and is destroyed by ferments.

Tests were made by Reis (1912), on the nitroprusside reaction of human cataractous lenses. The cortex and nucleus were separated and dried at 37° C., and then tested. Normally, the two parts of the lens give an equally intense reaction, but it can be seen that a pathological lens may lose the reaction from its cortex or its nucleus, or from both (see Table III).

TABLE III (REIS).

TYPE OF CATARACT.	NO. OF CASES.	NITROPRUSSIDE REACTION.	
		CORTEX.	NUCLEUS.
1. C. Hypermature	8	Negative	Negative
2. C. Mature	23	67 per cent. Neg.	98 per cent. Neg.
3. Unripe Cataract	20	15 per cent. Neg. 10 per cent. Pos. 75 per cent. Trace	85 per cent. Neg. 15 per cent. Trace —
4. C. Tumescens	1	Positive.	Trace
5. C. Traumatica	1	Positive.	Positive.

In the case of other tissues, such as muscle, it was shown by Arnold (1912) that the presence of cystein is correlated with an active metabolism. It is highly probable from the work of Reis and Jess, that this is also true of the lens. The slightest interference with the circulation of the eye, leads to degenerative changes in the lens. These may be due to a lack of oxygen, yet very little is known as to how the lens utilizes its supply of oxygen. Further, the peculiar mode of nutrition of the lens, prevents any excessive use of oxygen, or rapid elimination of waste products. Yet in order to maintain its transparency under all conditions, it is probably necessary for the lens to keep up an active metabolism.

A consideration of the work of de Rey Pailhade, Thunberg, Heffter, etc., on autoxidation systems, led Goldschmidt (in 1917) to the idea that a similar balanced system—SH—SS—might exist in the lens, whereby the latter would be enabled to carry on a metabolism involving very little wear and tear. By using a modification of Heffter's method (based on the power of cystein-containing tissues to reduce sulphur to H S) Goldschmidt found that the cystein content of the ox lens decreased with increasing age. If cystein were used in the inner respiration processes,

cystine would be produced, and the latter might either be re-converted into cystein by some intracellular mechanism, or simply be broken down and removed as a waste product. An estimation of the sulphur content of lenses of different ages, showed that the sulphur did not disappear from the lens simultaneously with the loss of cystein, but remained practically constant throughout life. It appears then, that the—SH—SS—system in the lens is reversible. The nitroprusside reaction of the lens may be some indication of the degree of autoxidation remaining in the lens.

Further work on the autoxidation system of the lens, has been done in recent years (1922-24), probably as the result of the stimulating effect of the discovery of glutathione (Hopkins, 1921), and of the work which led up to that discovery.

Abderhalden and Wertheimer, in the course of some experiments on autoxidation (1922), observed:

(*a*) That the oxygen uptake of the lens is very small being 1/8—1/10 that of muscle (*cf.* Ahlgren).

(*b*) That some of the SH-reacting compound of the lens is dialysable, *i.e.*, it is not all bound up with the protein.

(*c*) That the lens tissue will reduce m-dinitrobenzol (*cf.* Lipschitz). The lens becomes coloured gold in the process probably because cystine is formed.

(*d*) That alcohol accelerates the disappearance of cystein from the lens.

Gunnar Ahlgren (1923) and Goldschmidt (1924) have both made use of Thunberg's methylene blue technique to study the autoxidation of the lens. According to Ahlgren:

(1) The lens reduces methylene blue five times as rapidly as nerve, and half as rapidly as muscle.

(2) Cooling the tissue (*cf.* Thunberg's "cryolability of certain dehydrogenases"), and the presence of narcotics, hinder the reaction which occurs most rapidly at a certain optimum p*H*.

(3) Lens tissue will oxidize lactic, fumaric, malic and maleic acids, but not succinic acid.

Ahlgren suggests that the reduction power of the lens is due to an enzyme, and that possibly the lens contains a donator substance which acts as a substrate to the enzyme. The activity of the latter depends on the presence of a small amount of oxygen. He also recalls the fact that Lo Cascio showed the presence of oxidases and catalases in the lens (1922).

Goldschmidt's paper (1924) "Ueber die Autoxidation der normalen und pathologischen Linse," is worthy of a full summary:

(1) He recognizes the dialysable constituent of the lens, which gives a nitroprusside reaction (cf. Abderhalden and Wertheimer) as being glutathione.

(2) He finds that after exhaustive extraction of the lens with N/10 H_2SO_4 the residue still gives a strong NPR.

(3) By using the methylene blue technique, with proper precautions for buffering the lens tissue, and for obtaining the correct end-point, he finds that the unextracted tissue will decolourize the dye rapidly, whereas extracted tissue does so only after the addition of cystine (1 mgm. is sufficient).

From this experiment it is clear that the lens protein has the power to reduce cystine to cystein, and the latter is then able to reduce methylene blue in the usual way.

(4) After extraction of the lens with N/10 H_2SO_4 till the filtrate no longer gives a NPR, and then drying the residue with alcohol and *in vacuo* over H_2SO_4.

(*a*) The power of the residue to reduce cystine remains unchanged, and it is not destroyed by heat nor by exposure to a stream of air.

In these respects and in its insolubility in water, the residue entirely resembles the thermostable reducing system found by Hopkins in the muscle of the rat.

(*b*) The system can be absolutely destroyed by treatment with 0.5 per cent. hydrogen peroxide, and subsequent washing will not restore the reduction power. In comparison, a whole encapsulated lens offers some resistance to the action of H_2O_2, and after treatment retains some power of reduction, though the reduction time is much prolonged. Probably the lens capsule hinders diffusion into the lens. Also the H_2O_2 may attack the glutathione first and be able to oxidize only some of the cystein (or SH) of the thermostable system.

(5) By following Thunberg's data, Goldschmidt estimates that a whole ox lens can reduce 76.56 c.mm. of oxygen. He states, however, that this does not necessarily give accurate information as to the normal oxidation activity of the lens.

(6) At the end of a primary reduction experiment, *i.e.*, reduction due simply to the glutathione, the blue colour of the methylene blue could be restored by re-admitting air to the tube. The tissue was able to reduce the dye again, for as many as six times, in approximately the same lengths of time, *e.g.*, reduction times for:

(*a*) Quarter of a fresh ox lens—20, 34, 27, 32, 47 mins.

(*b*) Dried ox lens—21, 49, 48, 48, 45, 59 mins.

This experiment also supports the idea that the oxidation reduction system of the lens is reversible.

(7) Experiments on human lenses showed that the reduction time increased with increasing ages, and was much accelerated by the addition of cystine. Immediately reduction had ceased, the NPR was found to have vanished. This was not the case in the ox lens. The pathological human lens clearly contained a

thermostable reduction system, but it was not so easily isolated as from an ox lens. Also, in a pathological lens the reduction time seemed to depend on the state of maturity of the cataract. Lenses which had entirely lost their primary reduction power, regained it in the presence of cystine.

(8) The effect of change in hydrogen-ion concentration. For an ox lens the reduction power is at an optimum at pH. 8.3, and it ceases at pH. 6.0. The human lens is more sensitive to a change in pH., and it ceases to reduce if the medium is more acid than pH. 7.0.

In the discussion of his experiments, Goldschmidt remarks that it is still unknown how the lens activates the oxygen with which it is supplied. In the autoxidation system, glutathione most probably acts as a hydrogen donator, and is thus able to reduce such hydrogen acceptors as methylene blue (*in vitro*), or oxygen (*in vivo*). The thermostable system serves to reduce the glutathione after the latter has been oxidized. This explanation is a more probable one than that offered by Ahlgren. The power of the lens to oxidize certain fatty acids, is however, most likely enzymatic in character.

Some recent experiments by Adams (1924) on fresh animal lenses, confirm Goldschmidt's observations as to the presence of an autoxidation system in the lens. The oxygen uptake of the lens tissue was measured directly in a Barcroft microrespirometer, and parallel results were obtained by using Thunberg's methylene blue technique. The results may be summarized as follows:

(1) A whole ox lens was found to have a gradual oxygen uptake, *e.g.*, in two hours an ox lens of 2 gm.wt. consumes 125-130 c.mm. of oxygen. The uptake is accelerated and increased in the presence of glutathione, and markedly increased if both linseed oil and glutathione be present.

(2) The power of the lens to utilize oxygen is considerably decreased by drying the lens, and is entirely absent after dialysis of the lens. But addition of a few mgm. of glutathione to a suspension of dried or dialysed lens restores the oxidation power to normal.

(3) A thermostable residue can be prepared from the lens which has no oxygen uptake of its own, but with glutathione, it gives a typical oxygen uptake curve. It reacts also with linseed oil and glutathione together, and develops a large and rapid oxygen uptake.

(4) One of the three proteins of the lens, viz., β-krystallin, functions pre-eminently as a thermostable residue.

(5) The average glutathione content of an ox lens, as estimated by Tunnicliffe's method is 0.305 gm. per cent.—a high value in comparison with other tissues. A decrease in the amount of

glutathione was observed after the lens had been exposed to heat rays. The decrease was more marked after exposure to ultra-violet light.

Experiments on the degenerated lens prove that it is poor either in cystein or in glutathione or in both. That it suffers especially from a lack of glutathione, is shown by the fact that the cortex of a lens may have lost its reduction power, but will still give a NPR, *i.e.*, it still contains some bound cystein. Morgagnian cataract and c. traumatica, are forms of cataract in which both the primary (glutathione) system, and the thermostable reduction system are absent. In c. brunescens, however, only the primary system is lost.

Goldschmidt suggests that the most probable cause of all cataract which is not definitely traumatic in origin, is a gradual rise in the hydrogen-ion concentration in the lens. The—SH—SS— equilibrium is known to be very sensitive to such a change, and its upset would involve a decrease in oxidation. This added to the condition of increased acidity, might probably lead to precipitation of the lens proteins. Further, whereas normally the oxygen brought to the lens may be supposed to be used at once by the glutathione, in a disordered state of metabolism the oxygen might cause the oxidation of the cystein in the thermostable system. In criticism of Goldschmidt's view, it must be remembered that Burdon-Cooper has stated that in all cases of cataract which he examined clinically the aqueous humour was alkaline. It is difficult to believe that the lens would be acid if the aqueous were alkaline. Adams' observations suggest another way in which the autoxidation system of the lens may become disordered, viz.: That since ultra-violet and heat rays are both present in ordinary sunlight they may cause an appreciable destruction of the glutathione in the lens. This could occur in an alkaline aqueous humour.

Other theories as to the possible causes of cataract will be discussed more fully in the section of the paper which deals with the action of light on the lens. A review of the analytical work which has been done on the lens, would not be complete without a short summary of the facts known concerning its content of lipoids. Apart from the proteins these seem to be the only remaining constituents of any importance in the lens. Jacobsen, Kuhn, Cahns, and others noted that the lipoids seemed to increase in the senile lens. Leber (1905), suggested that they might play some part in the onset of cataract by providing a solvent for such harmful substances as acetone and butyric acid. The micro-chemical and pathological tests made by Toufesco (1906), also bore witness to an increase of lipoids in the senile lens.

Valentin (1919), identified glycerin ester, cholesterin ester, free

cholesterol, and a cholin-containing phosphatid, in the normal lens. He found from his experiments that some or all of these lipoid substances, which normally are in solution, might become deposited in crystalline or amorphous particles, which varied in composition and amount in different forms of cataract.

Goldschmidt (1922), made an analysis of human lenses of known ages, and found an interesting variation of the lipoids with age, *e.g.*:

(*a*) Cholesterin: Was at a maximum in the first year; at a minimum in the years 10-20; and rose again in the years 70-80.

(*b*) Phosphatid: Was very low (only 0.4 per cent.) in the first year; at a maximum (4.8 per cent.) in years 10-20; then underwent a fall 60-70; and finally rose.

(*c*) An acetone-soluble substance: Was at a maximum of 1.0-2.0 per cent. in the years 10-20, and fell steadily to 0.6 per cent. at 80.

(*d*) A benzol-soluble substance: Was at a maximum of 0.4 per cent. in the years 1-10, then fell to a steady level of 0.1 per cent.

Goldschmidt notes that in senile cataract, cholesterin crystals are often macroscopically evident in the lens. He suggests that the lipoids may act as oxygen fixators in the process of respiration. Further work is undoubtedly needed to elucidate the part which lipoids play in the normal lens metabolism, especially in view of the results recently obtained by Meyerhof (1924) and others, showing the remarkable acceleration of oxidation which occurs after the additions of lecithin to a balanced SH—SS—system.

Note on the Organ-Specificity of Lens Proteins

Uhlenhuth and others discovered that lenses of different species gave the same immune reactions, as proved by precipitin, anaphylaxis, and complement-fixation tests. Thus the specificity of the reaction is determined not by the species, as in immunity towards serum proteins, blood, bacteria, etc., but by the organ from which the antigen is derived. This organ-specificity of the lens is so pronounced that a lens anti-serum reacts with a lens of the same species, even of the animal which provided the serum.

It has been discussed whether this property is relative or absolute (Römer, and Gebb, and von Szily). Krusius suggested that the nucleus of the lens is responsible for organ-specificity, while the cortex proteins retain a certain degree of species-specificity. Hektoen (1923), failed to find any species-specific antigens in the lens.

The experiments of Schoeppe, and of Guyer and Smith, suggest that injection of lens protein into an animal may cause the

appearance in the blood of ferments which have a specific power of destroying all other lens proteins, *e.g.*, in the lens of the foetus. The evidence for and against this is, however, very conflicting.

For the purpose of this present article the importance of this immunilogical work on the lens is that it seems to denote a similarity in the chemical constitution of the proteins, and possibly therefore, a similarity in the metabolic processes which occur in the lenses of different vertebrates.

The Action of Light on the Crystalline Lens

In dealing with the chemistry of the lens, we have regarded it merely as an object for analysis, but in considering the effect of light upon it, it is a significant fact that we are dealing with an actively living tissue. From an early date the injurious effects of light, and especially of the invisible rays, have been known, and it has become impossible to regard the normal passage of light through the lens as an uneventful process. Instead, it is possible that light plays an important part in the chemical processes of the lens.

Quite early in the history of biology, it was discovered that ultra-violet light, in comparison with infra-red and visible rays, has a unique power of influencing living matter. It was not surprising therefore that in the early years of investigation on the effect of light on the lens, ultra-violet was considered the most likely cause of cataract.

It was shown by various workers, Brucke (1845), Donders (1853), de Chardonnet (1883), and Helmholtz (1896), that the media of an ox eye, viz., the aqueous and vitreous humours, the cornea and especially the lens, are able to absorb ultra-violet light. de Chardonnet also noted that the degree of absorption seemed to vary with the age of the lens. Although the methods used in these experiments were rather primitive, for they consisted usually in allowing ultra-violet light to pass through the eye medium on to a fluorescent screen, and the only measure of the power of absorption was the decrease in fluorescence, yet the results have been fully confirmed by later experimenters, *e.g.*, Widmark, Mascart, who worked on human as well as on animal lenses. Hertel in 1903, was able to show that the lens of a live rabbit absorbs ultra-violet light.

The work of Schulek, and Birch-Hirschfeld showed the significance of this function of the lens, viz., that by absorbing ultra-violet light, the lens protects the retina from injury. Merely half an hour's exposure to ultra-violet rays, *in vivo*, of a rabbit's eye, from which the lens had been removed, caused vacuoles to

appear in the nerve cells of the retina, and a disappearance of chromatin from the inner granular layer. No such changes were found in the retina of the normal eye, which was exposed in the same way, and its lens remained transparent. Further, in order to injure the retina of a normal eye at all, such a powerful source of ultra-violet light had to be used that the anterior structures were injured

The following classification given by Schanz and Stockhausen (1909), and confirmed later (1912) by E. K. Martin, shows to what degree the various rays of the spectrum are able to pass through the media of the human eye:

(*a*) Rays $\lambda 760\text{-}400\mu\mu$ are visible rays, and pass to the retina unchanged.

(*b*) Rays $\lambda 400\text{-}350\mu\mu$ produce fluorescence in the lens. They pass to the retina and become visible if the lens is removed.

(*c*) Rays $\lambda 350\text{-}300\mu\mu$ penetrate the eye, but are absorbed by the lens.

(*d*) Rays $\lambda 300\text{-}0\mu\mu$ do not penetrate the eye, but are absorbed by the cornea.

Record has often been made by de Chardonnet, Schulek, Widmark, Birch-Hirschfeld and others, that after removal of the lens for cataract, the eye has increased visibility in the ultra-violet end of the spectrum, and is superior to the normal eye in this respect.

It was suggested by Schulek, that the continual passage of light, and especially of ultra-violet rays, through the lens during life, must have some effect on that organ, especially if it absorbed them. It was only reasonable to suppose that it might lead to degenerative changes in which the lens became clouded, and which often seemed to terminate in cataract. This theory was supported by Handmann (1909), who noted that senile cataract began in the inner lower quadrant of the lens, *i.e.*, in the area most exposed to direct sunlight; and further, that in cases of cataract occurring in one eye only, it could be generally associated with the habitual position of the patient during work, whereby the affected eye was exposed to stronger light than its fellow. Also Chalupecky, who exposed lenses to the light of a quartz mercury vapour lamp, stated that he was able to produce in them changes similar to those which occurred in a senile lens. He differed from the popular theory, by denying that ordinary daylight was sufficiently strong in ultra-violet radiations, to be able to cause cataract in a lens. The theory was, however, further supported by the observations of von Hirschberg, and of Grosz. The former noted that cases of cataract were extremely numerous in hot climates, where the sunlight is very rich in ultra-violet light. Grosz reported that in Hungary, cataract occurred frequently among agricultural labourers, who worked all day exposed to the sun.

From 1907 onward, special study was made of the peculiar type of cataract which occurs among glassworkers, and in addition to an improvement in our knowledge of the action of ultra-violet light, we learned that infra-red rays were almost certainly a co-factor in the production of cataract. Indeed, some observers, *e.g.*, Meyhofer and Birch-Hirschfeld, considered that the cataract in glassworkers was entirely due to heat. Their theory was supported by Crookes, who in the course of investigations made for the Royal Society Committee in 1913, found that the light which came from the tanks of molten glass abounded in infra-red rays.

In criticism of the view that cataract could be due to the direct action of heat on the lens, Hess pointed out that the lens first became clouded in its hinder pole, whereas heat would exert its maximum effect on its anterior surface. Also, Vogt maintained that only a white heat would produce an infra-red radiation sufficiently penetrating to cause a harmful effect in the lens. Further, it would be difficult to explain the localization of the cataract in the centre of the lens, in view of the fact that the iris is a good conductor of heat.

Other investigators, *e.g.*, Leber, Hartridge and Hill, favour the view that heat might bring about cataract indirectly, by affecting the secretion of aqueous humour, or by causing the latter to become concentrated. The experiments of Hartridge and Hill (1915), and of Luckeish (1915), on the power of the eye media to absorb infra-red rays, showed that each separate medium, cornea, aqueous humour, lens or vitreous humour, gave absorption bands in the infra-red which closely resembled those given by equal thicknesses of water. Further, Hartridge and Hill demonstrated that heat radiations between λ 11,900 $\mu\mu$ and 7,000 $\mu\mu$ pass into the eye unchecked, and a great deal reaches the retina. The power of the iris to absorb heat is very marked, and is four times that of the lens, which absorbs only 12 per cent. of the light which reaches it through the pupil. They suggested that although the continual small absorption of heat might lead to a coagulation of lens proteins, yet this effect was more likely to be due to some interference with the nutrition of the lens. In support of a suggestion made by Parsons, viz., that the heat absorbed by the iris may affect the secretion of aqueous humour by the ciliary body, and hence may also disturb the nutrition of the lens, are the facts that:

(1) The greater part of the heat is absorbed by the posterior pigmentary layer of the iris, *i.e.*, the part which is in close contact with the ciliary processes, and with the posterior chamber of the eye. Any rise in temperature of the pigmentary layer, following

the absorption of infra-red rays, might be expected to affect the neighbouring ciliary processes and their glandular elements.

(2) A close relationship exists between the arterial supplies of the iris and of the ciliary body. It is possible therefore that both structures are supplied by intimately related lymphatic vessels, and vasomotor nerves. The latter may send some glandulomotor nerves to the ciliary processes.

(3) In glassworkers' cataract especially, the slow development of the pathological condition cannot be due to any process of inflammation, particularly as other structures in the eye remain unaffected.

Hartridge and Hill suggest the possible hypothesis, that secretion of aqueous humour is stimulated when heat rays fall on the iris. Since the stimulus occurs regularly and for long periods, the process of secretion may come to depend more and more on the external stimulus, and itself may become periodic. As a result of its interrupted nutrition, the lens may develop cataract, especially in its least well nourished part, *i.e.*, its hinder pole.

E. K. Martin (1912) observed some interesting physiological effects following the exposure of rabbits' eyes, *in vivo*, to ultra-violet light, viz.:

(*a*) After moderate exposure, the central cells of the anterior capsule of the lens became swollen and were obviously stimulated to active proliferation. It is possible that such a change precedes the formation of an anterior capsular cataract in the human eye.

(*b*) More severe exposure produced opacity in the cornea, while the capsule and lens remained undamaged.

(*c*) In rabbits previously sensitized to washed cats' corpuscles, the specific haemolysins could only be detected in the aqueous humour after the eye had been exposed to ultra-violet light, and not before. According to Römer's theory, the transmission of haemolysins from blood to aqueous humour only occurs after a simple paracentesis or following an inflammatory lesion of the iris or ciliary body. The latter condition may have been caused in these experiments by the exposure to ultra-violet light.

Although it is highly probable that cataract is a secondary heat effect, it cannot be denied that ultra-violet light is absorbed by the lens, and it probably assists in the precipitation of the lens proteins. The power of the human lens to absorb light of short wave-length, is known to increase steadily during the life of the individual, until at the age of 50 years, it absorbs the whole of the ultra-violet rays, the violet, and part of the blue rays. Yoshiharu (1922) has recently shown that absorption seems to vary with the protein content of the lens, a fact which leads one to speculate as to whether the increased absorption in old age, is due to the loss of soluble protein, and to the apparent replacement of it by

insoluble albumoid. Soret (1883) was able to show that yolk and serum proteins, as well as lens proteins, were precipitated as the result of the absorption of ultra-violet light. Dreyer and Hanssen (1907), stated that such precipitation involved a change from soluble, into insoluble protein.

Schanz (1916) made some interesting observations on the precipitation of yolk protein by ultra-violet light. He found that:

(1) Whereas a visible precipitate was formed in an acid protein solution, an alkaline solution merely developed a gold colouration. Addition of ammonium sulphate to the alkaline solution would bring down a precipitate, but the latter decreased with increased time of exposure.

It appears that ultra-violet light had a more drastic effect on the alkaline solution, and caused actual destruction of the protein. The gold colour may have been due to cystine.

(2) That a temperature of 45° C. had the same effect as light on alkaline and acid protein solutions. This was confirmed by Young (1921).

Schanz considered that the precipitation was a reversible flocculation, and not denaturation.

(3) Addition of alkali to a solution of dialysed protein, rendered its absorption power superior to that of a neutral or acid protein solution.

Experiments made by Burge (1915) at about this time, may be compared with those of Schanz. In contradiction to the latter worker, Burge found that whereas light from a quartz mercury vapour lamp would coagulate solutions of egg-albumen, globulin, and vitellin, it would not coagulate in the same length of time, the protein of a normal lens, neither was the latter coagulated after 100 hours exposure. If, however, N/100 solutions of $CaCl_2$, $MgCl_2$, magnesium silicate, or of dextrose, were added to the lens, it rapidly became opaque when exposed to light from the same source. In a further study of the importance of salts to the metabolism of the lens, Burge made some remarkable discoveries:

(1) That sodium and potassium salts, acting alone on the lens, can cause nuclear opacity.

(2) That calcium, magnesium, and silicates, occur in increased amounts in senile cataractous lenses, *e.g.*, calcium in a normal lens is less than 0.08 per cent., but in a cataractous lens may be 15 per cent. Cataractous lenses from India showed an enormous increase in their content of sodium and silicates as compared with the normal, *e.g.*:

	SODIUM PER CENT.	SILICATES PER CENT.
Normal Lens	?	0
Cataractous Lens	25.06	3.63

(3) Salts and substances, such as dextrose, which aid the action of ultra-violet light, also decrease the fluorescence of the lens (*cf.* Schanz showed that in the human lens, its power to fluorescence is decreased in old age, while its absorption of ultra-violet light increases).

(4) By exposing the eye of a living fish to ultra-violet radiation, Burge was unable to cause any opacity in the lens, when the fish had been previously kept in tap water. In fish which had lived for ten days in water containing 0.1 per cent. sodium silicate, 0.1 per cent. dextrose, 0.8 per cent. calcium nitrate, and 0.8 per cent. calcium chloride, he obtained a distinct opacity of the cornea after an exposure of six hours, and an opacity in the lens after a second exposure. Similar results were obtained from experiments on frogs.

As a result of his experiments, Burge considers that the lens normally has the power of converting the light of short-wave length which it absorbs into light of long-wave length, which it passes on to the retina. Thus, it disposes of the surplus energy which might otherwise disturb its chemical system, and cause precipitation of its proteins. Salts destroy this power if they are present in hypernormal concentration, and they modify the proteins so as to render them more easily precipitable by light.

This theory raises the question again, as to whether an increase of salts in the aqueous humour of the eye, might not be another important factor in the origin of such a condition as glassworkers' cataract (as Leber suggested), or of the cataract which occurs in tetany (Stoeltzner). Nelson (1923) has shown, however, by experiments on the surviving lens, that a solution of a calcium salt will not produce any appreciable clouding in the lens, unless it exceeds a concentration of 2.25 per cent. It is very improbable that the calcium in the aqueous humour would reach such a concentration in any pathological condition.

Somewhat in advance of the theory held by Burge is that of Neuberg (1917), viz.: That without the accompanying presence of salts, the lens proteins would be unable to absorb any light at all. He further maintains that no pure organic compound has the power of light absorption. His theory received some support in the observations of Bovie (1913), and Young (1921), that denaturation of a protein can only occur if electrolytes are present, but it is contradicted by Schanz. The latter worker found:

(1) That protein which has been dialysed till it is chloride-free, still gives an absorption spectrum.

(2) That after the addition of salts to a solution of pure protein, the latter shows an increase in its power of absorption of light, which cannot be attributed to the mere presence of such salts.

It is probable that both proteins and salts are photosensitive; in any case, perfectly pure proteins are not found under natural conditions.

(3) That chemically pure organic substances such as acetone, most certainly are sensitive to light. Acetone and dextrose, in particular, increase the effect of sunlight on solutions of lens proteins.

From this last observation, and from a study of the Hallwachs, or photo-electric effect of organic substances, Schanz believes that a process of photosensitization may be continually taking place in the lens. Thus, it is probable that the protein molecules are continually absorbing electrons which are thrown off by some organic sensitizer in the lens. Precipitation of the proteins might be the reasonable outcome of such absorption. In support of his theory, Schanz found that the addition of a protein to a solution of an organic dye, caused an actual diminution in the photo-electric effect of the dye. It is interesting to compare this hypothesis with an observation made by Schulek, as early as 1896: "*Alles was das freie Auschwingen der Elementarteile behindert, kann früher oder später zu Aenderungen des Aufbaues führen.*"

In conclusion, in spite of the numerous theories which have been brought forward, it is impossible to say that any one of them is an adequate explanation of the cause of cataract; each is probably a part of the truth. It certainly reveals how little is known of the chemical processes which constitute the normal metabolism of the lens, and how they are deranged in the onset of cataract. The phenomenon of the precipitation of the lens proteins has been studied too far apart from other chemical changes in the lens. Goldschmidt, and Jess and Koschella, have recently made an advance in the right direction in an attempt to explain the remarkable disappearance of the nitroprusside reaction from the cataractous lens. Jess and Koschella in 1923, repeated Chalupecky's experiments on whole lenses, but could find no diminution in the nitroprusside reaction of the lens, even after 36 hours exposure to the light of a quartz mercury vapour lamp. Removal of the capsule of the lens before exposure, or suspension of the lens in Ringer, made no difference in the result. They also repeated Burge's experiments and found that ultra-violet light acting on a lens suspended in 0.02 per cent. $CaCo_3$ solution, did not produce any trace of cloudiness. Adams (1924) observed a decrease in the glutathione content of the lens after exposure to ultra-violet light.

It must be remembered that Goldschmidt has given definite evidence that though the cataractous lens is often poor in glutathione the SH— of its protein may still remain. In lenses where there

is no trace of a nitroprusside reaction, and the autoxidation system is completely absent, there is a possibility that the loss of β-krystallin is the cause of both defects. Again, the observation of Abderhalden and Wertheimer, that ultra-violet light does not accelerate the oxidation of cystein, raises the question as to whether the loss of soluble SH— (chiefly glutathione), is a cause or result of cataract.

It is almost certain that some degree of hydrolysis of the lens protein occurs in cataract. The process of denaturation is according to the latest views, a first stage in hydrolysis (*cf.* the work of Harris (1923) on precipitation of egg albumen). Burdon-Cooper also states that he has constantly found deposits of tyrosine in cataractous lenses, and in the aqueous humour after the operation of needling. This suggests that hydrolysis may occur to a considerable extent.

The most suitable ending to a review on the crystalline lens is, not a summary of our imperfect knowledge of the subject, but a reiteration of the need for further investigation, especially from the biochemical standpoint.

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HAEMATOMA OF THE CORNEA. A CLINICAL NOTE

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WHILE preparing to perform a double sclerectomy on a female patient, aged 72 years, we observed a strange phenomenon which neither of us had ever seen before. The patient had absolute glaucoma in the right eye and a far advanced glaucoma in the left, the tension being nearly 90 and over 90 Schiötz in the two eyes respectively. We saw on the cornea of the right eye (absolute glaucoma) a couple of streaks of blood, about 1.5 mm. long, just below the upper part of the limbus. They seemed to be on the surface, but would neither flush nor brush away and did not stain the swab. As we watched, new streaks appeared on either side, spreading laterally further and further, and finally appearing as small bleb-like haematomata, protruding above the corneal level and occupying about 2/5ths of the circumference of the cornea. They exactly corresponded to the position of the most intense

part of an arcus senilis, with exactly the same sharp line of demarcation at the limbal edge and the same clear zone of cornea. A series of blebs thus formed, growing more and more prominent, till they became confluent and formed a band-like strip, broadening to about 2 mm. The whole process only occupied a period of about two or three minutes, when the bubbles burst and discharged a small quantity of liquid blood. Two days later there was no trace left. Probably an extravasation of blood took place just beyond the limbal vessels and wedged its way beneath the corneal epithelium, and, after elevating this off Bowman's membrane, finally burst it. The situation of this haematoma was interesting, as well as the clear zone of cornea, and doubtless has its anatomical reasons. But in spite of the similarity of position we do not think that there can be any true analogy between the anatomical causes of this appearance and those of arcus senilis. Arcus senilis is a degeneration, probably of a modified fat, occurring at the peripheral edge of Bowman's membrane, which does not quite reach the limbus (Collins and Mayou). It is likely that the haematoma here described formed just where the limbal circulation leaves its conjunctival support and pours its lymph into the cornea. The tissues and vessels being in a degenerate and friable condition in these regions in absolute glaucoma, they broke along the zone where they lose their conjunctival support, in a sharply defined line. We offer this as a partial explanation of what occurred.

ANNOTATION

Ophthalmology in Fiction

It must be conceded that the whole tone of the doctor in fiction has been immeasurably raised during the last century. Smollett, himself a medical man, draws, in *Roderick Random*, vile pictures of the general practitioners of his day, Messrs. Crabb and Potion, compounds of the charlatan and the buffoon; while his only educated physician that occurs to us is the one whom Perigrine Pickle met in Paris, who is usually regarded as a caricature of Dr. Akenside. How great a part the medical profession plays in fiction will be recognized by all who have thought about the matter; but ophthalmology and the oculist, being of comparatively recent development, do not find much place in English literature before the middle of the last century. Lytton, in *Night and Morning*, tells us of an interesting case of family strabismus, where Beaufort,

meeting Mrs. Morton, towards the end of the book, asks after her brother and is informed that he has retired from his business and has been succeeded by his son-in-law, Mr. Plimmins. Beaufort asks which of the young ladies Plimmins had married and is answered thus: "Jane, she had a sad squint. Tom, there is nothing to laugh at; we are as God made us—handsome is as handsome does; she has had three little 'uns." "Do they squint too," asks Beaufort. This time Mrs. Morton administered no reproof, but replied pensively. "Natur' is very mysterious; they all squint."

Dickens, in drawing one of his most famous characters, Mr. Squeers, gave him only one eye. Stevenson, a sick man all his life, has an occasional jeer at the medical profession; none more amusing than that in *The Wrong Box*, where among other details occurs: "the old gentleman who had passed his life wandering in a tweed suit on the Continent of Europe; and years of *Galignani's Messenger* having at length undermined his eyesight, he suddenly remembered the rivers of Assyria and came to London to consult an oculist. From the Oculist to the Dentist and from both to the Physician, the step appears inevitable; presently he was in the hands of Sir Faraday, robed in ventilating cloth and sent to Bournemouth; and to that domineering Baronet (who was his only friend upon his native soil) he was now returning to report."

Mr. Lemuel Gulliver noted, not in so many words, that the inhabitants of Lilliput were myopic. His own eyes were weak; while a novel use for his glasses was when he employed them to ward off the darts that were shot at him.

The most atrocious specimen of ophthalmology in English literature is probably to be found in *Poor Miss Finch*, by Wilkie Collins. The lady's traumatic cataract, the lover's epileptiform attacks which were treated with silver nitrate pills; the argyria resulting therefrom; the German oculist who spoke very bad English and performed wonderful operations in spite of the adverse opinion expressed by his English colleague; are these not all written in the book in question?

One of the nicest bits of ophthalmology in fiction is found in *Tristram Shandy;* the pretended foreign body in Widow Wadman's eye. "'I protest, Madam,' said my Uncle Toby, 'I can see nothing whatever in your eye.' 'It is not in the white,' said Mrs. Wadman."

We pass over those examples of ophthalmology that occur in modern works of fiction, such as in *The Light that Failed*, by Kipling; *The Four Feathers*, by Mason; and in *Sonia*; and will only express the hope that, in future, if an author wishes to introduce an oculist in his works, he will support home industries, instead of the more favoured Teutonic operators.

ABSTRACTS

I.—LENS

Adams, Dorothy Rose.—Investigations on the Crystalline Lens.

Miss Dorothy Adams, whose paper on the Literature of the Crystalline lens appears in this number, communicated a paper to the Glassworkers' Cataract Committee of the Royal Society which was read on April 2, 1925, and will appear in the Proceedings of the Royal Society. The following are her conclusions:

"The lens resembles other tissues in possessing an autoxidation system made of two sulphur-containing components: (*a*) water-soluble glutathione; (*b*) a thermostable protein residue. These are maintained in chemical equilibrium by an oxidation reduction change of SH-SS type. A system of this kind may be of economic importance to respiration of avascular tissue, such as the lens, since it could be maintained by a minimum fresh supply of energy (oxygen).

Experiments were made on fresh ox lenses. Oxygen uptake was measured directly and indirectly. It was found that:

1. Fresh lens has a definite oxygen uptake, evidently used for maintenance of its autoxidation system, since any alteration in concentration of glutathione in the lens causes corresponding change in oxygen uptake, *e.g.*, the oxygen uptake is considerably decreased by drying the lens, and is altogether absent after dialysis. In each case it is restored at once by addition of a few milligrammes of glutathione. Also glutathione and linseed oil together have the same remarkable catalytic effect on oxygen uptake of fresh lens as they have on muscle.

2. The average glutathione content of ox lens is higher than that of other more vascular tissues.

3. The thermostable protein residue prepared from the lens has no oxygen uptake; but with a few milligrammes of glutathione gives an oxygen-uptake curve exactly similar to that of fresh lens. It also shows the same catalytic effect in presence of oil and glutathione together.

4. Only one of the three proteins of the lens, viz., *β-krystallin*, is able to function as a thermostable residue.

5. Exposure of fresh ox lens to ultra-violet light or to heat rays causes measurable decrease in its glutathione content. Effect of ultra-violet light is more marked than that of heat."

II.—OPTICS AND REFRACTION

(1) **Landolt, E. (Paris).—How to assist certain amblyopes. (Comment venir en aide à certains amblyopes.)** *Arch. d'Ophtal.*, July, 1923.

(1) The amblyopes to whom **Landolt** refers are those whose defect of sight is due to opacities of the dioptric media and whose chief trouble is their inability to read even by the aid of a loupe. The author finds that such individuals can be greatly helped by increased illumination so arranged that light is concentrated on the paper or book. He has had an apparatus constructed by Meyrowitz in Paris which consists of a high power electric lamp enclosed in an opaque metal tube, in the lower wall of which is an aperture placed opposite the lamp. The tube is fixed horizontally to an upright stem and can be rotated and moved vertically at will. The light from the lamp is concentrated on the book beneath the tube while surrounding objects are in darkness. This light can be tinted if desired by coloured glass inserted in the aperture. Landolt's communication was read and the apparatus shown to the Société française d'Ophtalmologie at its meeting in June 1923.

J. B. LAWFORD.

(2) **Penel, Raymond.—The verification of spectacle prescriptions. (Vérification de l'exécution des ordonnances de réfraction.)** *La Clin. Ophtal.*, January,1924.

(2) Every oculist who takes an interest in checking the glasses for which he has issued a prescription knows how it is possible for errors of all sorts to creep in, and how fortunate it is that a wrongly prescribed or executed spectacle prescription is less likely to do positive harm than when medicines are in question. **Penel** presents the results of an investigation of his prescriptions, and also refers to the work of one of his colleagues—name unmentioned—who states that there are 78 reasons why spectacles "do not cure us." He gives as a summary of these reasons the following:—Initial error in the examination, defective trial lenses, asymetrical faces and wrong positions of the head when the patient is examined; too numerous transcriptions of the prescription in intermediate hands, absence of agreement about the notation of axes, errors of manufacture even with multiple control. Finally, there is the patient himself, or, by inference, the patient herself, for this is what the author has to say about the patient:—"It is necessary merely to take a walk upon the promenade in order to observe how wearers of glasses are more concerned with the set of their hats than with that of their glasses." Surely this cannot

apply to the male sex! But of the general truth of what Penel says there can be no doubt. And if mistakes readily occur with high-class work how much more likely are they in the case of contract work. The reviewer has had a large experience of this in connection with spectacles for school children, for, since the commencement of his connection with the Lanarkshire Education Authority ten years ago he has insisted on checking, so far as possible, every pair of spectacles ordered for the children by him. He has found that whether the spectacles are contracted for by a high-class firm or whether they are put through the hands of small local opticians who are often jewellers, the result is essentially the same, none of the contractors can be trusted to execute the prescription with the same exactitude as that with which a chemist executes a prescription for medicine. The prescriber also makes a blunder now and again, it goes without saying, but these are as nothing to those which occur in the course of execution of the prescriptions. In the case of contract work, it is perhaps hardly fair to expect too much from the optician since the prices are so cut that experienced assistants cannot well be afforded, but the facts remain, and their chief indication is that in contract work it is more than ever essential that the prescriber of the glasses should be in a position to verify the correctness of the lenses, and, very specially, of the frames.

ERNEST THOMSON.

(3) **Hepburn, Malcolm L. (London).—Treatment of myopia in young children.** *Lancet*, July 19, 1924.

(3) **Hepburn** contributes to the *Lancet's* series of special articles one of the best short accounts of treatment of myopia in young children which the reviewer remembers to have read. He gives the necessary facts with the minimum of side-stepping towards controversial subjects and presents a clean-cut statement which should be most useful to the practitioner. There appears to be a printer's omission where the letter J. presumably ought to read J. 1. The author says in his last paragraph: "in cases of definite progression, such as one or two dioptres in six months, the question of discontinuing all reading and school work has to be decided," etc. The reviewer considers that "one or two dioptres in six months" is too liberal an allowance of increase. He would call half a dioptre in six months or, at any rate, one dioptre in twelve months definite progression which would lead him to consider, in a young child, removal from school for a period.

ERNEST THOMSON.

(4) **Strebel, J. (Lucerne).—A new model of accommodation. (Un nouveau modèle de l'accommodation.)** *Rev. Gén. d'Ophtal.*, April, 1924.

(4) In spite of its title, the article by **Strebel** really deals with the whole subject of accommodation and the rival theories of its production; very little space with an insufficient description is given to the actual model illustrated. The article contains much interesting theory on a very difficult subject, but is not suitable for abstraction and should be read in the original. Two points only need here be noted, namely, that the author upholds the theory of von Helmholtz as against that of Tscherning, and makes the following statement:—"Miotics act not merely by increasing the circulation, drawing the iris farther from the irido-corneal angle, diminishing the depth of the anterior chamber, etc., but they have a special action in that by causing spasm of accommodation they bring about a mechanical pumping action on the canal of Schlemm. In fact the meridional portion of the muscle of accommodation passes to the canal of Schlemm and has its fixed point there. It is in this way that miotics bring about an assured improvement in the intraocular circulation which is impeded in glaucoma."

ERNEST THOMSON.

(5) **Schousboe, M. F. (Médecin Aide Major de 1re Classe.)—On a method of examination of the ocular fundus in high myopes. (Sur un procédé d'examen du fond d'oeil des myopes forts.)** *La Clin. Ophtal.*, September, 1922.

(5) It is common knowledge that in high myopia the image of the fundus on direct examination is, in the somewhat redundant expression of **Schousboe**, "woolly, indistinct, badly focused" though probably most of us will not admit that it is, in the author's word "useless." But it is probably not common knowledge that the fact has been noted by Tscherning without receiving an explanation. Nor does the author offer an explanation. The procedure described of examination by the indirect method merely consists in placing plus lenses up to 5 D behind the ophthalmoscope mirror, adjusting the observer's distance to suit, and thus obtaining a magnified image.

ERNEST THOMSON.

(6) **Dor, L. (Lyon).—Military pensions and slight diminutions of visual acuity. (Pensions militaires et diminutions légères d'acuité visuelle.)** *La Clin. Ophtal.*, October, 1922.

(6) From **Dor's** article one gathers that in France there is a considerable leakage of money paid as pensions for slight diminutions of visual acuity, which pensions are not wholly justifiable as they are based on the supposition that the soldier originally had a

visual acuity of 1, such visual acuity and the fractions thereof being based on a test at 5 metres only. As Dor points out, certain astigmatics and other ametropes cannot be brought up with any glass to more than 1/2 at 5 metres, and yet at 25 centimetres can do any kind of work without difficulty. The object of Dor's communication is, he says, to draw attention to the fact that the notation of visual acuity by ordinary fractions has a scientific appearance which is fallacious, and that it would be better to adopt a dioptric notation intelligible only to the oculist. When a non-professional person hears it said that he has a visual acuity of 1/2, he thinks that he has lost half of his sight and claims a pension, often in good faith, for fear of losing the other half. Dor's conclusion is that the military authority should be asked to consider the central visual acuity as the expression of only 2/3 of the useful function of an eye and not as the expression of its whole value. If this were done, compensation for loss of central vision (expressed by V = 1/20), which is at present counted as 45 per cent., would be counted as 30 per cent., and there would be a correspondingly lower compensation for slighter losses of visual acuity.

ERNEST THOMSON

(7) **Exton, William G, M.D. (New York).—The Euscope as an aid to microscopy.** *Jl. Amer. Med. Assoc.*, June 7, 1924.

(7) **Exton,** after investigating the effect of prolonged microscope work, comes to the conclusion that suppression of the image in the "off" eye is invariably accompanied by effort and strain. There is a close association between high magnifications and eye strain, and a relationship between intensity of light and loss of acuity. Posture is also a factor in the production of strain, the fixed position of the head and neck, and of the ocular musculature required by binocular microscopes causing discomfort for which the visual relief afforded by them does not compensate. The Euscope has, therefore, been invented to overcome these defects. It consists essentially of a camera having on its floor near the smaller end, an aperture to receive the eye-piece of the microscope. In this is placed a reflecting prism by which the light from the microscope is deflected down the camera forming an image on the screen at its far end. This image is viewed from the smaller end through a pair of sphere prisms or a strip of reading glass of proper focus.

Experiments with different materials have shown that a zinc oxide screen is the best. For routine work a 150 mm. square screen, 200 mm. from the reflecting surface of the prism, is satisfactory. Seen through the strip of reading glass the visual field has the apparent size of a full page magazine illustration—the image appearing crisp with three dimensional effect.

The observer is in an easy, natural sitting position, sees the stereo-like images with binocular single vision and by looking at a reflection on a screen instead of directly at the light source he avoids "irritation of the rods and cones with consequent fag of the visual purple." During the four years in which Euscopes have been used in the Prudential laboratory, not a single complaint of fatigue or strain has been heard.

Photography is of course very easy with this instrument, for instance, blood counts may be made photographically on bromide paper with 16 or 8 mm. objectives, which give a field large enough to include all the 400 squares of the haemocytometer slide. With this instrument it is possible to study magnifications up to 35,000 whereas the limit with the microscope alone is 2,700.

F. A. WILLIAMSON-NOBLE.

(8) **Wirgman, C. Wynn.—Vision and Target Shooting.** *Lancet*, July 12, 1924.

(8) In this interesting short article **Wirgman** deals with the adjustment of lenses for target shooting. He does not deal with the shot gun nor with the sporting rifle, because, with regard to the former, as is well known, the alignment of the gun is very little dependent on aim, and, with regard to the latter, shots are not always taken in a prone position; and it is in this position that the eye is specially rotated away from the centre of the frame. As this matter of centration is one of great importance to ophthalmic surgeons when dealing with cases of this kind, it seems well to transcribe the author's words:—"In prescribing glasses the point to which I wish to draw attention is that an ordinarily centred lens is not advisable, because in the position assumed when firing the eye looks through the upper and inner quadrant of the lens. . . . In the prone position the body is carried well away to the left, so that the head is inclined to the left also in the act of looking at the mark. The face is inclined at a more or less acute angle to the ground, and the right eye is slightly further from the target than the left (in a right handed man). This necessitates the line of vision passing, as has been pointed out, through some point situated in the upper and inner quadrant of the right lens, and, if no alteration of centre is mentioned in the prescription, a prismatic and curved image is produced. To counteract this, it is necessary (*a*) to raise the frame; (*b*) to centre the glass so that the line of aim and the optical centre coincide; (*c*) to bring the face of the glass parallel in the vertical plane with the target. Theoretically the shooting glass should be angled to correspond in the horizontal plane also, but in practice this is hardly needed. It will be found that an angle of 10 to 15 degrees back from the vertical is required

to fulfil (*c*). An angling joint can be used for this." There are other interesting points in this article which should be consulted in the original. The foregoing quotation deals with the most important point, the correction of the aiming eye.

ERNEST THOMSON.

III.—GLAUCOMA

(1) **Blatt, Nicolas (Roumania).—Hemeralopia as a prognostic symptom in glaucoma. (Hemeralopie als prognostisches Symptom bei Glaucom.)** *Wien. klin. Wochenschr.*, p. 403, 1921.

(1) **Blatt** has observed that the degree of the hemeralopic trouble in glaucoma depends on the malignity of the individual case. When a high degree of hemeralopia can be shown to be present, in a case of glaucoma, by the common methods of examination, experience proves that blindness rapidly ensues, and is not to be avoided by either operative or palliative methods of treatment. Whence the importance of hemeralopia as a prognostic factor.

V. ST. JOHN.

(2) **Hamburger (Berlin).—A new contribution to glaucoma. (Neues zur Glaukomfrage.)** Abs. *Zentralb. f. d. gesamte Ophthal.*, July, 1924. Heidelberg Congress.

(2) **Hamburger** first draws attention to the value of the undiluted suprarenin injection in glaucoma. He demonstrates the pressure curves of two cases of simple glaucoma. One a woman of fifty years and the other a man of eighty years. He treated both by the suprarenin injections. Prior to this, pupil, field of vision, and pressure, 40 - 50 mm., had remained unchanged in spite of eserin. After the employment of the suprarenin the eserin became effective. He states that by this supplementary use of eserin the effect of the suprarenin can be prolonged for several weeks or months. Twenty injections were made in the case of the woman and seventeen in the case of the man.

With regard to acute glaucoma he refers to the case of Heimann (*Med. Klinik*, 1924, No. 21). A cure was established here after injections of suprarenin, 0.2, and 0.4 c.c. respectively given at an hour's interval. With regard to this treatment Hamburger puts most value in its employment in chronic glaucoma. Instead of injecting, simple instillation into the conjunctival sac can be

employed (boracic or the tartrate combination of the Hochster Chemical Works, or the hypernephrin of the firm Sicco, Berlin). An ointment can be employed also, but the most effective is the injection method. The danger in employing this method is negligible, and acute glaucoma is not a contrary indication. One must keep to the maxim : suprarenin only when miotics fail to act. All the ten cases and those which were reported from Lucerne and Dresden—one being a one-eyed person—were relieved by the method. Hamburger gives as a rule eserin two hours after the injection to ward off an attack. The other objection, that of collapse, has been greatly exaggerated. One must not of course inject suprarenin directly into the blood stream. Hamburger has now at his disposal several preparations which do not alter the blood pressure, or only alter it locally. A big step has thus been made. The question of how often operation may be evaded has not yet been determined.

The Principle. The primary effect is due to blood being pressed out from the uvea which is a cavernous tissue. This effect is as transient as every suprarenin effect. The secondary effect is a long and much more important one, and is due to the fact that metabolism is stimulated in a very high degree in the region which was strangulated by the suprarenin, or according to Bier "was hungered, thirsty and choking."

Historical. The first experiments were made twenty years ago on animals by Wessely. In 1911 Zirm-Olmutz wrote an excellent thesis on the subject, but only the practical conclusions were arrived at. Köllner (1918) made the first experiments on man with success, but in 1920 stated that suprarenin had far less effect than eserin and has published nothing further. He failed, therefore, to recognize the therapeutic value of suprarenin. His doses were only 1/20 - 1/40 of those used by the writer. Hamburger claims priority for himself. He worked out the method eighteen months ago and is still working at it. He has carried this out in spite of the warning by Wessely on the danger of necrosis and the risks of the mydriatic treatment of glaucoma.

S. SPENCE MEIGHAN.

(3) **Salus, R.—Subconjunctival injection of adrenalin.** (**Subconjunctivale Adrenalin Injektion.**) Abs. *Zentralb. f. d. gesamte Ophthal.*, July 29, 1924.

(3) **Salus** describes the effect of subconjunctival injection of adrenalin according to the technique of Hamburger in a case of acute glaucoma, and reports also his results in twelve cases, among which were eight cases of glaucoma of varying types. In the main he confirms the results claimed by Hamburger. The

reduction of pressure varied in the different cases, and sometimes this difference was a great one. The author, however, does not show the optimism of Hamburger for the treatment, who claims that as a result of his procedure, operation in chronic glaucoma has been greatly limited. Clinically the procedure may be of advantage for definite purposes, such as the lowering of tension before operation, or it can be employed in these rare cases where miotics aggravate the condition. In the phase of increase of tension which follows cyclodialysis, it will be especially valuable on account of the property which the treatment possesses of loosening synechiae. Another advantage of the procedure is the facility with which ophthalmoscopic examination can be made as a result. This is due to the lowering of tension combined with mydriasis. In one case it was discovered that the cause of the glaucoma was a thrombosis of the veins, a fact which would not have been elicited but for the method. Twenty injections were given in cases without any disturbance, either local or general.

Elschnig and Kubik consider the employment of large doses of adrenalin dangerous from experience in their clinic (*Zentralb.* 12, 231).

S. SPENCE MEIGHAN.

(4) **Gradle, Harry S. (Chicago, Ill.).—The use of adrenalin in increased intraocular tension.** *Amer. Jl. of Ophthal.*, November, 1924.

(4) **Gradle,** after summarizing the recorded experiences of others with adrenalin in glaucoma, gives his own results. Between 1912 and 1917 he gave it subconjunctivally to six cases of glaucoma secondary to iritis with immediate and permanent reduction of the hypertension in four and no effect in the other two. In acute congestive glaucoma, and with tension over 70 mm. Hg. a colleague injected adrenalin subconjunctivally. An enormous mydriasis resulted and a marked reduction of tension so that in twenty-four hours, all congestive signs had disappeared. Gradle, therefore, advises its use in this disease, combining it with a powerful miotic and repeating it two or three times in twenty-four hours if the first injection is not successful. In two cases of chronic congestive glaucoma there was no benefit, and in three cases of non-congestive glaucoma, a slight reduction of tension was obtained in two and none in the third. It is, therefore, not advocated in these forms of the disease, especially as Hamburger has reported a case where an acute attack was precipitated. In hypertension recurring after operation, adrenalin may be of great benefit.

It is used as follows: The eye is anaesthetized with two per cent. butyn. Three to six minims of 1 to 1,000 adrenalin, obtained from

a sterile 1 c.c. ampoule, are injected under the conjunctiva at any convenient place—usually half-way between the lower limbus and fornix. A moderate amount of dull ache follows for about fifteen minutes, but massage is not used because the local and not the systemic effect of the drug is required. A suggested *modus operandi* is that the adrenalin brings about a diminution in the blood supply of the choroid and ciliary body, through its action on the sympathetic fibres controlling the vessels supplying them. The intraocular contents are thus diminished and the iris is no longer pressed forward so as to block the angle of the anterior chamber.

F. A. WILLIAMSON-NOBLE.

(5) **Liebermann, L. von. — The treatment of glaucoma by retro-bulbar injection of novocain-adrenalin according to Fromaget. (Die Behandlung des Glaukoms mit retrobulbaren Novokain-Suprarenin-Injektion nach Fromaget.)** Abs. *Zentralb. f. d. gesamte Ophthal.*, July 29, 1924.

(5) **Liebermann** reports good results from this procedure. He thinks that the principal value lies in the fact that operation can be carried out under favourable conditions. Complications after operation are hereby lessened. He cannot go so far as Hamburger who claims that under the adrenalin treatment operation in glaucoma has been limited to the utmost.

S. SPENCE MEIGHAN.

(6) **Grosz, von (Budapest). — Indications for cyclodialysis. (Indikation zur Cyclodialyse.)** Abs. *Zentralb. f. d. gesamte Ophthal.*, July, 1924. Heidelberg Congress.

(6) **E. von Grosz** speaks of the adoption of cyclodialysis, an operation which has step by step taken the place of trephining in cases of chronic glaucoma. Iridectomy has maintained its place unshaken in acute congestive glaucoma, both in the prodromal and in the acute stages. While in 1919, in the Budapest University Eye Clinic No. 1, 119 iridectomies, 74 trephinings, and 3 cyclodialyses were performed; in 1923, 111 iridectomies, 17 trephinings, and 58 cyclodialyses were performed. In the first six months of 1924 50 cyclodialyses were done. Anterior sclerotomy was performed in juvenile glaucoma, that of Lagrange in simple glaucoma. Cyclodialysis has the advantage that it is less dangerous than the other glaucoma operations. In 3 per cent. only was there a loss of visual acuity. It has been done with success even in cases of the haemorrhagic type. It can be repeated and can exceptionally be combined with an iridectomy. Remarkable results were

obtained where the operation was performed for secondary glaucoma in cases of dislocation of the lens. Tension was reduced in all eleven cases. In five cases the visual acuity was improved.

The effect produced by the operation has not been finally established. The detached uvea falls chiefly backwards, and in some cases a one-sided atrophy of the ciliary body was the outstanding feature. During the last ten years at the University Eye Clinic No. 1, 1,960 cases of glaucoma have been operated on. These operations were as follow: 1,101 iridectomies, 565 trephinings, 146 cyclodialyses, 23 Lagrange operations, and 125 sclerotomies.

The influence on tension, due to disturbance of the internal secretion, on the ground of the work of Hertel and v. Szily, and especially from the important communication of v. Imre will be thoroughly investigated. The co-operation of a specialist in the person of Professor Csepay will be included. The results will be communicated later.

S. SPENCE MEIGHAN.

(7) **Axenfeld (Freiburg).—The treatment of glaucoma in high myopia. (Zur Therapie des Glaucoma simplex bei hochgradiger Myopie.)** Abs. *Zentralb. f. d. gesamte Ophthal.*, July, 1924. Heidelberg Congress.

(7) **Axenfeld** in 1920 demonstrated the symptomatology of the combination of simple glaucoma and high myopia. This combination is by no means rare and is often overlooked. He then recommended the operation of cyclodialysis for those cases which had not been arrested by non-operative measures. To-day, however, after further observations, he finds that the method is not always successful, although there is nothing to be said against it in many cases. There are cases, however, in this category where trephining is the only hope. In myopes this operation is easy to perform on account of the anatomical arrangement of the parts.

In one case the speaker found a serious acute glaucoma to supervene after a cyclodialysis, which was uncomplicated at the time of its performance. Eserin cut short the attack and a trephine operation completed the treatment. An acute glaucoma after cyclodialysis is, however, very rare. He does not consider, therefore, that the operation is totally discredited on this account, but draws attention to the fact that such an incident may happen.

S. SPENCE MEIGHAN.

(8) **Salzer (Munich). — A simplified method of taking the visual field after Bjerrum, and its practical value. (Die vereinfachte Gesichtsfeldaufnahme nach Bjerrum und ihre praktische Bedeutung.)** Abs. *Zentralb. f. d. gesamte Ophthal.*, July, 1924. Heidelberg Congress.

(8) In his paper **Salzer** points to the fact that Bjerrum's method has somewhat been given up. He himself only employs it with regard to the 20° - 25° of the field. He uses as a screen, a cardboard square, 1 metre 20 centimetres in diameter. He does not employ small test objects. Either the test objects of Uhthoff, or an illuminated ground glass, 1 cm. in diameter is used. The latter can be made smaller by placing screens before it. In the same manner colours can be introduced. The illumination is regulated by means of a rheostat. The results obtained are transferred by means of a tangent rule, which reduces the readings by 10. Salzer describes the intermediate scotomata which are found in: (1) Diseases of the accessory sinuses; (2) papillary congestion; (3) optic neuritis; (4) papillary and retinal haemorrhages; (5) myopia and choroiditis; (6) glaucoma; (7) arteriosclerosis.

He has observed that in a number of cases the scotomata remain unaltered over a period of years, and in others he has observed that they may spontaneously disappear. They can no longer be taken as a guide for operation in increase of tension, nor can they indicate when the accessory sinuses should be explored. The author considers the increase in tension in glaucoma to be a complication in itself. He does not operate, therefore, unless this increase be present. He recognizes, however, that the presence of the scotomata and true glaucomatous cupping are related.

S. SPENCE MEIGHAN.

(9) **Constantin, Dr.—Pilocarpin, eserin and adrenalin in glaucoma. (Pilocarpine, ésérine, adrénaline dans le glaucome.)** Abs. *Zentralb. f. d. gesamte Ophthal.*, August 26, 1924.

(9) **Constantin** points out that pilocarpin stimulates not only the oculomotor sympathetic fibres, but also the inhibitory fibres of the cervical sympathetic. These latter dilate the vessels of the uvea, increase the secretion of the ciliary body, and bring about a hypertension. These injurious effects are balanced by the stimulation of the oculomotor sympathetic. These fibres cause a contraction of the pupil when stimulated and thus free the angle of the anterior chamber and spread out the absorbing surface of the iris. Eserin is of less dangerous nature as its only action is to stimulate the oculomotor sympathetic fibres and thus cause a contraction of the pupil.

The following case is described: In an eye affected by cataract and suspected glaucoma, preliminary iridectomy and extraction were performed. A normal after-course was pursued. Then attacks of inflammatory glaucoma supervened. Miotics were employed unsuccessfully. Paracentesis caused bleeding into the anterior chamber. Eventually sclerotomy was carried out, and this without success so far as results were concerned. Instillations of adrenalin were directly successful. Lowering of tension, disappearance of corneal haze, and increase in the visual acuity were the results. At one end of the healing sclerotomy wound, on the following day, a fistula developed. This was attributed to the delay caused in healing by the anaemia of the tissues. Adrenalin which is almost without effect in glaucoma becomes a valuable means of assistance after sclerotomy in favouring the formation of fistulae.

S. SPENCE MEIGHAN.

BOOK NOTICES

Principles adopted for Electric Lighting in H.M. Naval Service, being the first Report of the Admiralty Electric Lighting Committee. London: H.M. Stationery Office. 1924. Pp. 51 with 12 diagrams. Price 9d.

Their Lordships of the Admiralty appointed in 1921 a Committee to investigate the Electric Lighting of H.M. Ships and Establishments, with a view to recommending principles upon which lighting schemes should be based in future. The Committee consisted of Mr. Ernest T. Williams, Mr. F. Purser Fletcher, Commander Barry, and Surgeon Commander Hall. No ophthalmologist was appointed, but the Committee had the opportunity of hearing the views of Mr. R. J. E. Hanson.

This first report deals with general principles, and the Committee propose to issue separate reports dealing with specific problems at a later date. In a recent paper in the "Revue des Deux Mondes," Marshal Lyautey, to whose work the excellent hygienic state of modern Morocco is largely due, is credited with the statement that there is no separate military and civil hygiene (*il n'y a pas une hygiène et une santé militaire, et une hygiène et une santé civile*). The same may well be said of naval and civil illumination, as is well illustrated by the report under notice. There is a brief note on medical considerations to indicate the way in which defective illumination may affect the eye and the health of the worker. There is a happy misprint in the note on miners'

nystagmus in which it is stated that "by many it is claimed that the character of the illumination also plays a very important part in the causation of the diseases (*sic*)." If ever a disease was entitled to a plural it is miners' nystagmus. Four pages on the elementary theory of illumination follow and are succeeded by a list of recommendations for position, nature of lights, shading, etc. Two appendices follow, the first giving a list of the illumination values recommended for the different parts of a ship, and the second dealing at greater length with the general principles of light and illumination. Twelve useful diagrams are included in this section. The only criticism we feel inclined to make on this section is that it is very condensed and might well be supplemented by the perusal of some such work as that of Clark ("Lighting in Relation to Public Health") recently reviewed in these columns. Presumably the carrying out of details will be done by officers specially trained for the work and familiar with the use of photometers, etc. In this case a detailed account of the practical working of such instruments need not be included. We hope to receive the more specialized reports later.

The Routine Examination of the Eye. By BASIL LANG. London: Edward Arnold & Co. *1925.* *Price 6s. net.*

This book is of the pocket type, that is to say meant for the student to carry about with him and to read while he is examining a patient. In it the author has laid down one definite manner of carrying out each part of the examination of the eye. In the preface he states: "It may not, in the opinion of some, be the best way, but it is a perfectly satisfactory way," and with this the reviewer thoroughly agrees. The table of contents gives the order which the student should adopt in the examination of the patient. The book consists of 152 pages, is well written, and full of useful tips. There is one most notable omission, namely, the description and use of the slit-lamp, which, although an instrument of comparatively recent date, should not have been omitted from a volume of this kind. The description and use of the electric ophthalmoscope, so valuable in bedside examination, has been completely omitted, except as a means of transilluminating Hutchinson's teeth.

In the preface it is stated that great pains had been taken to avoid ambiguity, and to attain this a male surgeon is described as examining the eyes of a female patient. On page 46, this seems to lead to complications in the following sentence: "The surgeon and nurse are both seated, the child's body being supported on the nurse's lap while the surgeon holds her head between his knees."

The book is well printed in clear type. There are thirty illustrations, principally of instruments. Five or six of these are devoted to the measurement of exophthalmos. Some are not of the most recent type, as, for instance, Lister's perimeter is not illustrated, the old type of McHardy being given.

The book ought to prove useful to beginners in ophthalmology.

Sight Testing. (Funktionsprüfung des Auges mit einem Anhang Physiologie und Pathologie der Pupille.) By W. WICK. Pp. 146 with 90 diagrams. Berlin: S. Karger. 1924. Price 5.40 marks.

It was Aunt Pullet in "The Mill on the Floss" who shook her head at the idea that there were but few who could enter fully into her experiences in pink mixture and white mixture, strong stuff in small bottles and weak stuff in large bottles, damp boluses at a shilling, and draughts at eighteen pence. The student of ophthalmology is in much the same position with regard to his books on refraction and functional examination; there are a great many of such works in every language. The present work may be compared to the strong stuff in small bottles of Mrs. Pullet's category, in that it is a small brochure which covers the ground very fairly. The diagrams are clear and the mathematical part of the subject is reduced to a minimum.

Refraction and Accommodation of the Human Eye. (Refraktion und Akkommodation des Menschlichen Auges.) By A. SIEGRIST, Bern. Roy. 8vo, pp. 6 + 148, with 108 illustrations, for the most part in colour. Berlin: Julius Springer. 1925. Price gold mark 18.60.

This little book is the author's annual course of lectures in the University eye clinic in Bern. Written primarily for students, the requirements of practitioners have also been considered. The author's aim has not been to give an exhaustive treatise on the subject and in consequence no mathematical formulae are included. The contents, except in the absence of mathematics, follow classical lines; the book is liberally illustrated and as far as it goes strikes us as being very well done. We do not remember to have seen anywhere such good coloured reproductions of the fundus appearances of staphyloma verum posticum as are furnished in these pages, and the pictures of retinal detachment deserve a word of praise. A description of the ophthalmometer takes up a good deal of space, and there are three pages crowded with illustrations of every conceivable size and shape of eyeglass, which seems to us unnecessary. Printing and paper are excellent, and the book should appeal strongly to those Teutonic students who are content to work out refractions in a rule of thumb manner

without any thought of the mathematical principles underlying the subject.

Contribution to the Psychology of Sight. An experimental peep into the unknown soul-life. (Beiträge zur Psychologie des Sehens. Ein experimenteller Einblick in das ünbewusste Seelenleben.) By EMIL BERGER. With 4 figures and 8 stereoscopic plates. Munich: J. F. Bergmann. 1925. Price, mark 1.80.

In spite of its odd-sounding sub-title this little pamphlet is worth perusal. The stereoscopic figures are for the most part simple and strike us as being better than the well-known Kroll's pictures, though they do not appear to be as interesting for children as the stereoscopic plates issued by Underwood for fusion training. As we understand the author's thesis he is more concerned with visual psychology than with training squinters; though the one has a large bearing on the other. As a study on stereoscopic vision his little work can be recommended with confidence.

CORRESPONDENCE

CHANGES IN REFRACTION IN DIABETES MELLITUS.

To the Editor of THE BRITISH JOURNAL OF OPHTHALMOLOGY

SIR,—Further to Mr. Duke-Elder's highly suggestive paper in the April number, and especially with regard to the anomalous group into which Mr. Laws's cases seem to fit, the following case may be of interest:

Mrs. B, aged 40 years, was admitted to Mansfield Hospital on November 18, 1923, as an in-patient, and was regarded by Dr. Flint (to whom I am indebted for the notes on her general condition) as a mild diabetic. A few days before admission the urine sp. gr., 1035, contained "a large quantity of sugar." This seems to have been a variable quantity and easily controlled. On admission blood sugar was only 0.20 with a urine of sp. gr., 1040: and on the two following days "no sugar" was reported. There was a total amount for first three days 24, 23, 30 oz.

She was referred to me ten days later for defective vision, noticed for some six or eight weeks. I found R. and L.V. unaided less than 6/60, media clear, fundi normal. With +5.00D sph. R. and L.V. = 6/6 partly. She had never required glasses for distance or near work. After twelve days in hospital, dietetic treatment only, she was discharged, the urine for three days before this measuring 45, 50, 68 oz., and on each day "sugar-free" to Fehling.

Under Dr. Flint's care she remained much the same till April 5, 1924, when owing to continued excretion of sugar she was re-admitted. On April 8 and 9, 10 units insulin were given, reduced to 5 on April 10, and she has continued with this small amount till a week ago, when I saw her again.

She came for a mild conjunctivitis, R. and L.V.=6/6 unaided. She told me her eyes had rapidly improved after I had ordered the +5D sph., and that on January 2, 1924, she was able to dispense with these and had not used them since!

She now reads Jaeger No. 2 easily: the media are clear and fundi normal; shadows +0.25D vertical; +0.5D horizontal.

Dr. Flint reports that 5 units kept her sugar free for a year and that he is now administering raw pancreas.

This case then, a very mild diabetic (renal?), contrary to rule developed a high-grade hypermetropia, +5D sph.; and lost it under simple dietetic treatment.

I find it difficult to fit this case into any of the theories propounded, and one wonders whether at an unstable age there may not have been a sudden flooding of the system with the products of an endocrine gland which may have indirectly altered the refractive index of the lens.

Yours faithfully,

NOTTINGHAM,
April 25, 1925.

A. CHRISTIE REID.

VISUAL REQUIREMENTS OF MOTOR DRIVERS

To the Editor of THE BRITISH JOURNAL OF OPHTHALMOLOGY

SIR,—In the April number of your journal you refer at some length to a report read before the Ophthalmological Section of the American Medical Association in June of 1924. It might be well to accentuate that this report has not yet been accepted by either the Section on Ophthalmology or by the American Medical Association, indeed, it was referred back to the committee for certain modifications in the visual standards.

The report, with these modifications, will be presented at the coming meeting of the Association in May and, if accepted by the Section on Ophthalmology, will, in conjunction with standards prepared by the Section on Preventive and Industrial Medicine and Public Health, which cover examinations of other parts of the body, be submitted to the House of Delegates for action. If this be favourable, the entire matter will be referred to a department of the Association which has charge of public health and policies with a view to introducing the standards into the various States of our country.

It is natural, I suppose, that our committee should think better of the standards they have suggested than their British colleagues apparently do. To us the requirements seem moderate and practical. All examinations are put in the hands of qualified practitioners, with provisions for a re-examination by a Board of three practitioners in all vexed or doubtful cases.

The expedient suggested by the *British Medical Journal* to require no standards of physical fitness other than the signed declaration of each candidate: "that to the best of his belief he has no defect or disease which makes him unfitted to drive a car or motor-cycle," seems to us to place too great a strain upon the judgment and conscience of the average individual.

Our committee is hopeful that the standards they have proposed may be better received in America than the *British Medical Journal* and the *British Journal of Ophthalmology* believe they warrant, and have a more general adoption than the suggestions embodied in the excellent report of the Council of British Ophthalmologists published in 1920.

Yours very truly,

WM. CAMPBELL POSEY
for The Committee.

PHILADELPHIA,
April 24, 1925.

NOTES

Deaths

WE do not as a rule comment on the death of even outstanding members of the medical profession, unless they were, in life, in some way connected with ophthalmology; but exception must be taken in the case of Sir Rickman Godlee, Bart., K.C.V.O., whose recent death will be fresh in the minds of our readers. A past master in the writing of biographies, he wrote for us the splendid monograph on Wharton Jones, published in an earlier volume; and the kindly appreciation, in itself a very difficult task, of Sir Jonathan Hutchinson which appears in this number; while his life of his uncle, Lord Lister, is a model of what a biography should be. It is most unfortunate for us that he died before he could begin a biography of Sir William Bowman, which he had undertaken to write. No one else could have done it so well.

We regret to record the death of Julius Hirschberg on February 17, in his 82nd year. Born in Potsdam in 1843, he had a distinguished career at school, began his ophthalmic work in von Graefe's clinic in Berlin, and also studied in Vienna, Prague,

Paris and London. His literary output was enormous. He founded the *Centralblatt für Augenheilkunde* in 1877, and edited it to its final volume in 1919. But apart from pure ophthalmology he was a classical scholar of world renown, and a historian of ophthalmology second to none.

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Ophthalmic Benefit

WE hear that negotiations between the Joint Councils of the British Medical Association and British Ophthalmologists and the Ministry of Health have been going on for some time.

Agreement as to the administration of ophthalmic benefit has been reached and has been subsequently presented to the Approved Societies who, in general, approve of the scheme. It is probable that it may come into working order towards the end of this summer.

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Appointments

DR. K. K. K. LUNDSGAARD has been appointed Professor of Ophthalmology at Copenhagen University.

MR. A. H. H. SINCLAIR has been appointed a Medical Referee under the Workmen's Compensation Act, in place of Sir George Berry, resigned.

SIR WILLIAM LISTER has been appointed Honorary Ophthalmic Surgeon to the Guildhall School of Music, succeeding the late Sir Anderson Critchett in the post.

MR. R. C. DAVENPORT has been elected Moorfields Research Scholar.

DR. FELIX TERRIEN has been appointed Professor of Ophthalmology in the Paris Faculty of Medicine.

FUTURE ARRANGEMENTS

1925.

June 2.—Midland Ophthalmological Society, at Oxford.
June 12.—Section of Ophthalmology, Royal Society of Medicine (Annual).
July 14-17.—Convention of English-speaking Ophthalmological Societies, in London.
July 21-24.—British Medical Association, at Bath.
October 6.—Midland Ophthalmological Society (Annual), at Birmingham.